Food Manufacture
Incorporating Canning, Packing, and Preserving

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Food Poisoning.

AT THE Twenty-fifth Annual Convention of the National Canners' Association, held in February, reports were presented outlining the researches carried out in the Association's laboratories during the past year. At the University of Chicago, Dr. E. O. Jordan has continued his investigations into food poisoning, which are leading to the discovery of the real cause of outbreaks that, for lack of information, have hitherto been attributed to canned foods. In addition, a number of outbreaks have been investigated in the field and many others have been studied through the medium of local physicians and health officials.

This is an example of organised co-operation between industry, university laboratories, and public health officials, which might well serve as a model. Some such arrangement initiated in this country would undoubtedly serve a very useful purpose.

Heat Penetration.

During the last canning season the Association's laboratories studied the heat penetration of string beans, tomatoes, fish chowder, etc. Experimental packs of string beans were studied to determine to what extent over-filling of the can affects the rate of heat penetration; this effect was found to be negligible up to the point of a very tight fill well beyond the limits of usual practice.

Tests are being carried out to determine if pressure retorting would materially reduce the time necessary for sterilisation of canned tomatoes; if so, the retort capacity can be increased without purchase of additional equipment; the data were, however, conflicting and have not yet led to a definite answer.

A useful piece of work consisted in formulating a process for sterilising sweet potatoes, which is difficult to carry out successfully because of the low rate of heat penetration, and because of the susceptibility of this product to caramelisation on long exposure to high temperatures.

Spoilage by Sugar.

In December last we commented on the Association's researches into the problem of thermophilic infection of sugar. The general conclusion arrived at was that sugar, while not the only source, is the main source of bacterial infection of non-acid or semi-acid products. During the same month this subject was discussed in a paper by Cameron and Bigelow entitled " Elimination of Thermophilic Bacteria from Sugar," published in *Ind. Eng. Chem.*, Vol. 23, No. 12, 1931.

The outcome of this work is that the majority of U.S. sugar producers have announced their ability and willingness to produce sugar to comply with the tentative standards issued by the Association's research laboratory in March, 1931. Moreover, canners' sugar amply complying with these specifications was sold to canners during the last summer by refineries which formerly furnished sugar containing so many spoilage bacteria as to constitute a serious menace.

Pre-sterilisation.

It is well known that with some products it is necessary to process to a degree sufficient to destroy spoilage bacteria of substantially greater resistance to heat than any bacteria that are known to be injurious to health. This has suggested to the research staff of the National Canners' Association the possibility of " pre-sterilising " fluid products of slow heat penetration under steam pressure and agitation, and then follow after canning with a second process sufficient to safeguard health, thereby procuring sterility without undue damage to quality. Experimental packs have been put up on a small scale basis, and it is hoped to extend the work to

tests under factory conditions. It appears that spore death rate is much more rapid while the product is under agitation than when it is not; apparently this is independent of the heat penetration factor.

Perforation of Cans.

Kohman and Sanborn have continued their work on the effect of acidity on the development of hydrogen springers and perforations, and it is now amply demonstrated that the dangers are greatest with the lowest acid fruits. Thus, the addition of lemon juice to canned prunes has made practical the distribution of this commodity.

An interesting case which bears on this subject is the spraying of citrus fruits, which has been shown to lower their acid content, probably because of the arsenic in the spray. This has turned attention to the possibility of this practice being the cause of the losses which have been experienced in packs of Royal Anne cherries, which it has been the custom to spray during the past few years. Experiments have been instituted to test this theory.

There are, however, certain departures from this simple correlation between acidity and tendency to perforation, and they appear to have their origin in a variation in the fruits themselves, but at present the matter is obscure.

Vitamin Studies.

Kohman's tenth and eleventh articles on vitamins in foodstuffs, arising out of work conducted co-operatively with Columbia University, were published during the past year. These two papers are of interest to the entire canning industry. The former was entitled "The Vitamin Content of Some Common Vegetables" (*Ind. Eng. Chem.*, July, 1931), and the latter, "A Canned Food Diet" (*Ind. Eng. Chem.*, September, 1931). The animals fed on canned foods have thrived so well as to indicate that there may be some benefit resulting from a diet of cooked foods due to their greater digestibility. This is of such significance that a new series of experiments have been initiated.

Deterioration of Peas.

Kohman and Sanborn have also investigated the rapid deterioration of peas after vining (we commented on the bruising of vegetables in the October issue). The off flavours developed have commonly been ascribed to vine juice and weed juice. This explanation does not appear to be tenable. The real cause lies in the bruising that the peas receive in the vining process and the wet condition under which the shelled peas are held.

Since freshly harvested peas actively consume oxygen and give off carbon dioxide, it was suspected that this process might be affected by the bruising which peas received in the viner. To test this, peas were dropped from a third story window on to a hard surface; it was found that their oxygen consumption was markedly lowered. On the other hand, their CO_2 evolution was increased. This provided evidence of abnormal reactions taking place in the bruised peas.

The effect of bruising is apparently to form a layer of broken tissue on the outside of the pea wherever bruising occurs, which does not permit oxygen to enter to the unbruised centre. A similar effect may be produced by a drop of liquid on the outside of the pea; thus, the vine juice, by moistening the pea, tends to lower the normal oxygen consumption. The same effect on the flavour is produced by holding the peas under water or in an inert atmosphere such as nitrogen, or by freezing and thawing them.

Cloudy Liquor.

The conditions which bring about excessive turbidity in the liquor of canned peas have not been clearly understood. This question is being studied by the Washington laboratory and many experimental packs were put up last season. The results already obtained indicate that definite information will be available before the coming season. The subject is of particular interest at this time because U.S. Government officials have been considering the addition of a requirement for clear liquor to the present standard for canned peas.

In the preliminary report on this problem, a list of fifteen factors is cited that have been thought by canners and other authorities to account for the development of cloudy liquor in canned peas.

Toughening of Peas.

It has been shown that peas can absorb calcium salts readily, either from the water used in blanching and washing or from the brine added in canning. The effect of this absorption is to toughen the skins of the peas, roughly in proportion to the amount of calcium absorbed The source of the calcium may be hardness of the water supply or impurity of the salt used in making brine.

Work conducted by C. A. Greenleaf indicates that when peas are exposed to a strong brine made from *pure* salt, calcium is rapidly extracted from the skins. If, however, the brine is made from salt containing calcium compounds, the extent of this extraction of calcium is diminished, or, if the salt contains enough calcium (about 1 per cent.) the calcium content of the skins remains unchanged.

Tomato Ripening.

Kohman has already published useful data on the effect of the ethylene treatment of tomatoes (*Ind. Eng. Chem.*, October, 1931). It seemed that by the use of ethylene tomatoes might be picked before being fully ripe, and thus avoid cracks and develop-

ment of mould. However, further researches by Kohman have shown that ethylene has no effect in increasing the ripening of tomatoes, except when they are picked at such an early stage that they are not ready to begin to turn colour on the vines. Tomatoes picked at such an early stage are, of course, unsuitable for canning.

Empire Food Resources.

In connection with the efforts which are being made to develop Empire food resources, an event of outstanding importance is to take place in London during the period May 21 to June 4. We refer to the Nation's Food Exhibition at Olympia, an exhibition of home and Empire foods and food products organised under the auspices of the Greater London Grocers' Council for the purpose of demonstrating to retailers and public alike the variety and extent of the Empire's food resources.

At the inauguration luncheon given on March 16, the Earl De La Warr (Parliamentary Secretary, Ministry of Agriculture) pointed out that we now imported about two-thirds of our requirements of foodstuffs, and that it was urgently necessary to increase home agricultural production in order to reduce these imports. The Government's agricultural policy, which included duties on certain horticultural produce, a 10 per cent. import duty on most foreign agricultural produce, a wheat quota, and cheap feeding stuffs and manures, coupled with, and dependent on, an increased efficiency in the organisation of the industry, was directed to increasing the production and consumption—first of home agricultural produce and then of overseas Empire produce.

There is no doubt but that this novel exhibition will perform a valuable service in showing how far our daily wants can be provided from both home and Empire sources, and this in turn should have a stimulating effect on the food manufacturing industries in general.

Quick Work!

Recently it was stated in the daily press that Sir Ernest Debenham's factory at Milborne St. Andrew in Dorset has a capacity of 30,000 gallons of milk, or 240,000 sealed cartons, per day, the present output being 32,000 cartons daily. The statement was also made that paper was shaped to a carton, waxed, filled with a pint of fresh pasteurised milk, sealed, and completed within six minutes.

Lemon Cheese.

We have been frequently asked by manufacturers for some practical advice as to how best to avoid the moulding of lemon cheese. In a general way our reply is usually to the effect that the problem reduces itself to one of taking every reasonable precaution to avoid infection by mould spores, and is therefore largely a matter of maintaining strictly hygienic conditions throughout every stage of processing and packing.

The other day, in the course of a chat with Mr. John Elsbury, this subject cropped up, and he related some simple precautions which he had effectively put into practice during his long experience in American factories.

When the lemon cheese reaches a temperature of 180° F., hold it there for 15 minutes. See that your hand-pan is perfectly dry; merely wiping it is not enough; place it in a hot room. The same applies to the stirrer, jugs, glasses, jars, etc. Avoid the use of cold, unboiled water, as this may carry mould spores and thus prove a source of infection.

After filling the jars, wipe the rim of each with a clean rag that has been dipped in glycerine. Make sure that the lemon cheese is cold before putting on the paper circles, which should also have been dipped in glycerine and drained. Above all, do not store the product with anything that is mouldy or in a room into which the rain can blow. As Mr. Elsbury says, if a jar of mouldy lemon cheese is stood in a room and then a second jar of perfectly clean material is placed on the other side of the room, it will not be long before this also becomes infected.

If through faulty supervision or some other reason, mould infection still persists, the best thing to do is to place 5 lbs. of glycerine to each 100 lbs. of lemon cheese when the latter is at a temperature of 170° F. and just before finishing at 180° F.

The Price of Bread.

When the clauses of the Wheat Bill were made known, at least one daily newspaper blazoned forth to the world on its placards "Dearer Bread Bill." While the quota system may possibly result in a slight increase in the price of bread—though this is by no means a certainty—it is well that we should keep a balanced view and realise how fortunately the people of Britain have been placed as to the price of bread.

Fairbrother, in concluding his review of Cereal Chemistry, published in the January, 1932, issue of Food Manufacture, stated that "in 1931 the bread of Britain has been better in quality and lower in price than ever before and cheaper and better than anywhere else in the world." This was no imaginative statement as a careful comparative study of bread prices in different countries will show.

Prices Compared.

In the Editorial Comments of *Milling* (March 5, 1932) some very interesting figures are quoted. The price of bread in London is 7d. per 4-lb. loaf; in Liverpool the price is 6d. In France "ordinary"

bread is 1s. per 4-lb. loaf, whereas "fancy" bread costs 2·25 francs per 700 gms., or about 1s. 5d. per 4-lb. loaf. In addition, everyone knows that what is worse than the high price is the poor quality of bread in France. In Holland good quality white wheaten bread costs 11·43d. per 4-lb. and a lower quality 10·16d.; rye bread is dearer and costs 14¼d. per 4-lb. In Rome the cost of best small loaves works out at 1s. 11d. per 4-lb., a lower quality 1s. 7½d., whereas even the poorest quality made in very big loaves costs 9½d. per 4-lb. The only European country which compares favourably with Britain as to price of bread is Belgium, where it is about 6d. per 4-lb. loaf, but again the quality is very much lower.

The Future.

Some newspapers seem to believe that the effect of the Wheat Bill will be to increase the price and/or lower the quality of the bread. With this we are not in agreement, although the former supposition is a possibility. There is no reason why the price of bread should rise beyond a fraction, even if the whole of the quota payment is borne by the consumer, so long as the quota payment is not unduly increased. On the present basis the quota payment works out at something like 0·4d. per 4-lb. loaf. Whether this will satisfy the demands of the farmers is a matter on which we cannot express an opinion, but taking things as they stand at present, we see no reason for the panicking statements that our bread is going to be dearer, still less that the quality will suffer.

Stale Bread.

A great deal of work has been done and innumerable articles written on the problem of staling of bread, but nobody seems to have arrived at the real cause. In fact, it is difficult to say just when bread becomes stale. Some authorities believe that bread begins to grow stale the minute it has cooled, and therefore it is only a question of degree. Ordinary bread is not considered stale by the trade the same day that it is baked, but is so regarded on the second day.

Various theories have been put forward to explain staling. One is that much of the moisture in bread is held by the starch which is gelatinised in the baking. On cooling the starch gives us some of its moisture, which is absorbed by other constituents, especially the coagulated gluten of the crumb. The crust changes from a brittle material to a soft, pliable one, and the crumb increases in firmness and loses its tough elastic nature and becomes crumbly. If bread in this condition is heated it takes up the properties of fresh bread, and stales again on standing.

L. H. Bailey (*Cereal Chemistry*, 1932, p. 63) has carried out an investigation of the conditions that govern staleness, with a view to finding some substance which when added to a bread dough would retard staleness. In the course of the work he has used dextrinised starch, invert sugar, honey, malt extract, potato flour, sour dough (lactic bacilli), dairy products, protective colloids such as agar, mayonnaise and lecithins, calcium peroxide, and carbon dioxide. A few of these substances seemed to retard the staling slightly, but none produced entirely satisfactory results. Some interesting observations were made by keeping bread at a temperature below freezing and allowing it to thaw out gradually, when it exhibited some of the characteristics of fresh bread. It was also found that bread wrapped in waxed paper staled as rapidly as unwrapped bread.

Sunlight and Milk.

Some time ago Whitehead (*Biochem. J.*, 1930, p. 579) discovered that sunlight brings about a decoloration of methylene blue in milk. This reaction, which is independent of bacteria, is accompanied by an oxidation of some part of the milk fat. When whole milk is exposed to sunlight it develops a "cardboard," or tallowy, flavour, due to the oxidation of the milk fat. It is not likely that the methylene blue itself has anything to do with the changes which take place. It merely provides a visual indication of the intensity with which the oxidation of the fat is taking place—in effect, an "oxidation indicator." Milk samples exposed to sunlight, with or without methylene blue, develop the tallowy flavour, but neither the tallowy flavour nor the reduction of methylene blue occurs in milk from which the fat has been removed, and hence it appears tolerably certain that the two phenomena are dependent upon a single oxidation—reduction reaction.

Whitehead (*Biochem. J.*, 1931, Vol. 25, p. 1647) has now applied the potentiometric method of Clark to the investigation, and his results show that the oxidation of fat in whole milk under the influence of sunlight causes the development of a reducing potential, which can be detected either by its effect on methylene blue or by measurement electrometrically. Heated milk and raw milk give similar results. Separated milk, in many cases, undergoes no change under the influence of sunlight, but some samples show a fall in potential which is not at present satisfactorily explained. It has not been found possible to reproduce the effect of sunlight by the use of either ultra-violet radiation or radiation from electric lamps. On the whole the author considers that under certain conditions a dye may give a truer indication of the oxidation-reduction potential of a solution than the potential on an electrode.

The Canning of Cream

By A. SAMSON, A.R.C.S. A.I.C.

A brief discussion of the main practical points to be observed in the successful canning of cream.

IN THE preservation of cream by heat treatment, certain physical changes take place in the product which, if not controlled, would render the final product unsaleable. Such changes consist of coagulation of the milk proteins, separation of the fat (known as "creaming"), crystallisation of the mineral salts (such as calcium lactate) with the production of "grittiness," and so on. Most of these changes can be produced by improper sterilisation, and since this is obviously the most important part of the procedure adopted in the canning of cream, it will form the chief subject for discussion in this article.

Preliminary Treatment.

The milk producing the cream should be as fresh as possible and its acid content must be at a minimum. The cream is obtained by means of the usual cream separators.

After separation, the cream undergoes a process of "homogenisation." The purpose of homogenising is to prevent the separation of the fat in the cream after sterilisation. Briefly, this is done by breaking up the fat globules so finely as completely to envelop them by the surrounding milk and so prevent them coalescing to form a "cream line." This "breaking up" action is performed in the homogeniser, which, in the customary type, is a machine wherein the milk is forced under high pressure through minute apertures. The homogenising action increases the viscosity of the cream, and so inhibits the rising of the fat.

In order to prevent the fat in the cream becoming hard and buttery, the cream is heated before it enters the homogeniser. The fact that the cream is hot during homogenisation assists the minute dispersion of the fat globules.

Homogenised cream may be considered an excellent emulsion of oil or fat in buttermilk.

It is not proposed to enter into a discussion on the temperature of the hot cream at the time of homogenisation, nor on the pressure and the type of homogeniser required.

Sterilisation

As the cream emerges from the homogeniser, it is filled direct into cans. The cream may still be hot or warm, the cans being double-seamed immediately after filling and then sterilised.

It is important to realise that to obtain a high quality product the cream must be agitated during sterilisation, hence stationary retorts will never give excellent results. Tinned cream is, therefore, sterilised in agitating retorts. The agitation may be in one direction only, as when the tins roll on their own axis, or the tins may be rotated about the centre of the machine, or, again, the tins may be agitated in all directions.

The accompanying illustration gives an example of a steriliser, wherein the tins revolve about the centre of the machine.

Agitating Retorts.

Owing to the fact that any organisms present in the cream before sterilisation are well protected by the butter fat, cream sterilisation requires careful consideration and control. Moreover, the heat treatment during sterilisation alters the viscosity of the cream, and also the colour.

In stationary retorts, sterilisation produces a cooked flavour in the cream, hence the advisability of using agitating sterilisers. The steriliser illustrated consists of a horizontal cylindrical vessel. Inside the machine is a framework, made up of cages, which revolves about the axis of the vessel. The tins are loaded into the cages, so that they revolve about this axis.

Briefly, the mode of operation is as follows: After the steriliser has been fully loaded and closed, water is run into the vessel, so that it is about one-third full. The cans will therefore be submerged in water once during each revolution. The interior framework is set into motion, the cans now revolving about the centre. Steam is injected into the water, which gradually rises in temperature. A definite time is taken to reach sterilisation temperature, and throughout the process the framework is revolved at a definite speed, while the sterilisation temperature is maintained for a predetermined length of time. At the end of this period, a drain valve at the bottom of the steriliser is opened and the water is forced into an overhead tank, ready to fill the steriliser for the next batch. Cold water is then run into the machine, and is continued until the cans are cooled. The cages are kept revolving during the whole process.

When cold, the rotating movement is stopped, the water drained off, the cans are removed, and the steriliser is now ready to take a fresh charge and to repeat the sterilisation process.

Having considered the process in a general

An Agitating Retort for Cream Canning.
(Courtesy of John Fraser and Son, Ltd.)

manner, the individual factors which contribute to the success or failure of the sterilisation process may now be discussed.

Practical Points.

It will be noted that the framework is rotated throughout the whole operation of sterilising and cooling. The speed of rotation is important. The rotation of the can produces gentle agitation of the contents, with the result that heat is transferred from the walls of the can to the interior of the contents. Cooling is also rapidly effected by agitation. Moreover, the agitation, by mixing the cream, prevents the formation of a " cooked " flavour so noticeable in stationary sterilisation.

If the agitation or rotation of the frame is too rapid, the viscosity of the cream will be partially destroyed, and the cream will tend to form " grains." If, on the other hand, the rate of rotation is too slow, heat penetration will be so retarded as to impart " cooked " flavours to the product, as well as to spoil the cream colour. Extensive experiments have proved that the best speed of rotation is six to nine turns per minute.

Another important phase is what is known as the " coming up " time. This must be neither too brief not too long. A period of 15 to 20 minutes should be allowed to raise the temperature of the steriliser and cans to the sterilising point.

The temperature of sterilisation should be controlled within well-defined limits. It should not exceed 245° F., as both the colour and flavour are affected at higher temperatures. The lower limit is 230° F.

The temperature of sterilisation is maintained for a definite time depending on the size of the can. The shortest time is 15 minutes.

During cooling it is essential to allow a definite length of time in order to obtain a high quality article. Cooling should take about 20 minutes.

It is important that the steam circulation in the steriliser be thorough, and it is for this reason that the vessel is one-third filled with water.

Care should be taken in packing the cans to allow free circulation of the steam.

Good canned cream can be produced only from good fresh milk. From a high quality raw material it is possible to prepare high-grade canned cream.

Strict attention must be paid to sterilising temperatures and times and the period of cooling, in order to prevent inferior quality canned cream produced by " off " flavours and colours, " grittiness," " graining," churning, and separation of fat. An efficient homogeniser is an important machine in a cream cannery.

Above all cleanliness is most essential.

REFERENCES : *The Technical Control of Dairy Products*, Mojonnier and Troy.

Helping the Canner in U.S.A.

The following notes have been received from an American canner, who writes: "I have been a reader of Food Manufacture *since it was first published and have had occasion to obtain information from you which has been both useful and interesting. I am sending you some notes to mark my appreciation; possibly they will be of service to English readers."*

THERE IS probably no country in the world where the canner has so much practical information readily available as in the U.S.A. A brief study of the activities and functions of the various agencies collecting and disseminating this information should prove stimulating to the British canning industry, particularly at its present stage of development. There is no doubt that the development of safe and standardised canning practices in the U.S.A. has contributed tremendously to the growth of the canning industry and to the recognition of canned foods as a staple commodity in American life.

It will probably surprise some people to learn that, according to the figures of the National Canners' Association as recently as 1919, the average number of workers employed in each cannery was only twenty, and is probably not very different at the present time. Of course, the large nationally and internationally famous organisations operate a chain of factories and have thousands of employees, but there is no doubt that quite a large proportion of the goods canned are produced in small unpretentious establishments operated on the proverbial shoe-string.

As a matter of fact, it is not an uncommon sight in the rural districts of the States to see the farmer running a line of canning machinery in a converted barn, thereby preserving his surplus crops of corn, tomatoes, and the like. This would not be possible if there were not available exact information regarding the proper procedure for preserving the various products, which is passed on to the small canner by the supplier of his cans or equipment.

It is quite unusual for the canner to make his own cans in the U.S.A., and cans are, therefore, available at a low price, produced in tremendous quantities in specialised factories located at strategic points.

Canning machinery is easily obtainable, with the result that a cannery can be operated with a minimum of capital outlay and does not necessitate expert supervision. The system has its disadvantages, however, as very often the products of these small canneries, although technically sound from the viewpoint of spoilage and preservation, leave much to be desired from quality considerations. This has led to the enactment of the McNary-Mapes Law, as it is termed, which provides for the establishment of definite standards of quality to which all canned goods must conform; those of lower quality being obliged to bear a label to that effect.

The industry as a whole suffers from periodic attacks of over-production, due to crop or marketing conditions, and probably the technical efficiency of the industry contributes indirectly to this phase by making canning of staple products relatively simple. There is no doubt that the development of standardised canning practices and the co-operation of the various agricultural research agencies have been a tremendous factor in the growth of the industry, and thereby of considerable benefit to the consumer, the grower, and other industries related to canning.

Perhaps the largest organisation which contributes to this development is the United States Department of Agriculture and its associated activities. The canning industry is influenced chiefly by the work of the Bureau of Plant Industry and Entomology and the Bureau of Agricultural Economies. In these departments hundreds of scientifically trained workers are attacking the problems connected with the proper

selection of varieties and methods of cultivation of various crops, with the eradication of insect pests and the combating of plant diseases, and with the preparation of periodical reports as to crop prospects. All this is designed to provide the grower with information which will help him to obtain the maximum yield and the optimum quality for any particular crop, and as the canner, if he is not a grower himself, is dependent on the growers, all this information is equally valuable to him.

The results of this work are published in bulletins of various types (Farmers' Bulletins, Technical Reports, etc.), which are generally available free of charge or at a nominal cost to anyone sufficiently interested to write to Washington.

Probably the average grower will come more directly into contact with the Department of Agriculture through the State Agricultural College or Experimental Station. Each State maintains one or more institutions of this type, supported partly by State and partly by Federal Government funds, where research and educational work are carried on intensively and applied especially to the crops or products of the particular State.

It is estimated that over 20,000 trained workers are employed by the various State Agricultural agencies, engaged in research work of various kinds and in extending the results of this work to the individual farmer. With all this army of workers engaged in improving the quality of his raw materials the canner is, therefore, in a favourable position to commence his actual manufacturing operations.

The Department of Agriculture, in the early stages of the industry, was responsible for the first attempts to work out safe and sanitary canning procedures, but in 1907 the canners themselves formed a voluntary association—the National Canners' Association, which has devoted itself exclusively to the canner and his needs. The Association established a research laboratory in 1913 which has done invaluable work in placing the industry on a scientific basis.

By a careful study of the types of spoilage likely to occur in any product, together with a study of the habits of the organisms responsible, standard methods of handling have been worked out for each product from the selection of the raw materials, through the preparation for canning and the final retorting and cooling processes, with the result that losses, due to spoilage, have been reduced to a minimum, while the quality of the canned products is as high as can be attained commercially.

Studies have been made of the fundamental problems of tinplate corrosion, the effect of enamels, and discoloration of products in the can. Some of this work has been published in the trade or technical journals, but the more practical applications are embodied in a series of bulletins available only to members of the Association.

Members contribute to the Association an amount dependent on the number of cases packed during the year by the member, and the Association is also supported by the suppliers of canning equipment.

The Association has also done valuable work in dispelling popular misconceptions regarding the wholesomeness of canned foods, in particular exposing the "ptomaine poisoning" theories which at one time caused such a prejudice against canned foods.

Recently the Association made a thorough investigation which shows that the vitamin content of canned fruits and vegetables compares favourably with the raw product, and there is no doubt that this is very valuable in the U.S.A., where the consumer is much more concerned about getting his daily vitamins than he is in England.

In addition to the work done by the National Canners' Association, which deals with problems of a type applicable to the industry as a whole, the large can companies maintain completely equipped research laboratories where more specific problems peculiar to the individual customers of the can companies are studied. The can companies also supply exact details as to canning procedure and technique to any of their customers, and thus make available to the small canner the accumulated experience of the Department of Agriculture, the Canners' Association, and the can companies themselves.

In most States the canners have formed associations of canners or packers operating in that State, and hold periodical meetings where problems of mutual interest can be discussed, all aimed at improving the quality and increasing the market for canned goods, thereby increasing the profits of the individual canners.

The only criticism which might be made of the whole structure of research and information available to the canner is that the technical research aspects—crop improvement, canning processes, and the like—appear to have developed more rapidly than the market research side. There seems to be a growing tendency at present to concentrate more on better market and distribution methods, which should benefit the industry as a whole.

There is no doubt that the present high standing of the canning industry in the U.S.A. is due as much to the careful and scientific study which has been given to the raw materials and canning procedure as it is to favourable geographical or climatic causes. There seems no reason why a similar intensive study should not reap the same benefits in England.

The canners in the U.S.A. have shown how this development can be made by a voluntary organisation of their own creation, and, with the British Government willing to co-operate as the Department of Agriculture co-operates in the States, there should be a very bright future for British canners.

Chicken in Glass

The following information has been received from an American source.

PACKERS OF fruits and vegetables wishing to establish a winter pack, and who are so situated as to be able to procure supplies of poultry at reasonable prices, should find it desirable to include a line of chicken delicacies in glass. Poultry farms have two sources of profit—one the sale of eggs, and the other the sale of chicken. The profitable layers are the pullets, or young hens, not over a year old. It is the custom, and long has been, to clean out the stock every autumn, selling the last season's laying chickens to make room for the pullets which are to be the layers of the coming season. With many poultry farms doing this, the market becomes glutted with poultry at one season of the year.

It is important to utilise the by-products of the chicken to make this line profitable, and an outlet for chicken broth, etc., is desirable. The following gives a number of recipes for a complete line of chicken packing, together with information on processing.

Chicken in Jelly (Boneless Chicken).

100 lbs. chicken.
2 lbs. onions, chopped.
1 oz. bay leaves.
1 oz. whole mace.
2 ozs. whole cloves.
3 lbs. salt.

Draw and clean the chickens; cut each in eleven pieces; place in kettle and cover with water, adding the salt, and onions and spices in a bag; bring to a boil and simmer until tender; remove the chicken and carefully skin and bone.

Separate the white meat from the dark meat. The white meat is placed in bread pans of the ordinary domestic variety, pressed down by hand, and the chicken broth is poured over the white meat and the pans chilled to form a mould of chicken, which is sliced in very thin slices and used for an outside lining of the jars. The jars are then filled with pieces of the dark meat, together with the smaller scrap pieces, and, after one or two attempts, it can be decided upon as to just how much white meat and just how much dark meat should be used so that the entire chicken is used without waste.

The broth which results from the cooking of the chicken is used to pour in the jars so as to make a solid pack. This "jelly" is prepared in two ways, as follows:

1. The broth is reduced by boiling after a number of chickens have been cooked in the same water so that it jells on cooling.

2. A sufficient amount of gelatine (say from 10 to 15 per cent., depending upon conditions), is added to some of the broth, resulting in a jelly of firm consistency which holds the package together when cool. The jelly is poured as hot as possible so that it will run through the meat.

The packages are sealed with, for example, special "Anchor" caps at as high a vacuum as possible and processed as follows:

Contents: 8 ozs. or under, 240° F.—75 minutes; over 8 ozs. 240° F.—90 minutes.

The coming up time should be about 45 minutes.

Potted Chicken.

90 lbs. chicken.
10 lbs. salt pork.
5 lbs. onions, sliced.
4 lbs. salt.
1 lb. parsley.
½ lb. ground white pepper.
¼ lb. whole cloves.
2 ozs. mace.
1 oz. bay leaves.

Cook and skin the pork. Draw and clean the chickens; place in kettle with 2 lbs. of salt, the onions, parsley, cloves, mace, and bay leaves; cover with cold water; bring to a boil; simmer until tender; take from kettle and remove skin and bone; grind to a fine paste; mix the remainder of the salt and pepper with it. Place in glass jars, seal with special cap under vacuum, and process the same as "Chicken in Jelly."

Roasted Chicken.

Draw, singe, clean, and truss the chickens. Clean the giblets; place in kettle; cover with cold water; bring to boil and simmer while chickens are roasting. For each chicken put in two thin slices of bacon.

Cover the bottom of pans with water in which salt has been dissolved (1 lb. for 100 lbs. of chicken) and put in pans in oven and cook 1 to 1½ hours; when done, take chickens and bacon out of pan and make sauce.

To each pint of grease add 1 lb. of butter and 1 pint of flour, mix smoothly, and add 2 gals. of water in which the giblets were cooked; put on fire and stir constantly until it boils; chop the giblets fine and mix them in the gravy with ¾ lb. salt, 1½ ozs. of ground white pepper, and enough caramel to make a brown colour.

Place chicken in glass jar and fill one-third full with sauce.

Process the same as "Chicken in Jelly."

Stewed Chicken.

Draw and clean the chickens; cut each one in eleven pieces; place in kettle and cover with boiling water; bring to boil and simmer until tender; remove from kettle; skin and carefully bone. Fill in jars and cover with the following sauce:

To each 2 gals. of the liquor in which the chickens were boiled, add 1 pint of flour, mixed with a little

cold water; stir in and bring to boil; add 1½ ozs. of ground white pepper and ¾ lb. salt. Place in jars and process as "Chicken in Jelly."

Fried Chicken.

Clean in the usual manner, split lengthwise or cut in quarters. Sear in hot grease, sprinkle with salt and pepper, or, if preferred, dip in flour or cracker crumbs mixed with salt and pepper. Fry until nicely browned in the same way as preparing for table. The canning may be done in different ways, as follows:

Canning Dry, without Removing the Bones.—Pack in glass jars, add no liquid; cap and process—1½ hours at 250° F.

Canning with Gravy, without Removing the Bones.—Packs in jars, and fill to within ½ inch from top with boiling gravy.

Process same as for "Chicken in Jelly."

Fricasseed Chicken.

Clean chicken in usual manner and cut in pieces. Place in a kettle with enough water to cover. Tie in a bunch, for each 2½ lbs. of chicken, 2 branches of parsley, 1 small piece celery, a sprig of thyme, 1 bay leaf, and small piece of leek. Add 1 teaspoonful salt and 1½ teaspoonfuls pepper. Let boil for 15 minutes. Add 12 small peeled white onions and 1 good-sized potato, peeled and cut in little cubes. If desired, 2 or 3 ozs. of sliced and diced pork may be added. Cook for ½ hour. Remove chicken and herbs. Cut meat from bones and return to kettle. Allow it to boil and then pack hot in jars to within ½ inch from top, distributing meat and soup evenly in all the jars. Add ½ teaspoonful of finely chopped fresh parsley to each jar.

Pack hot in jars and seal with special caps under vacuum.

Soups.

Good soup cannot be made without good materials. Pure soft water must be used. If nothing but hard water is obtainable, soften it by dissolving ½ oz. ammonium carbonate to each 12½ gals. Always use cold water to cover the meat. Skim off coagulated albumin which rises as it comes to a boil; if not promptly removed it settles to the bottom and makes it more difficult to clarify.

Process Times.—The process time for soups in quarts is 50 minutes at 250° F.; pints, 30 minutes at 250° F.

Chicken Soup with Rice.

150 gals. water.
800 lbs. chicken.
50 lbs. onions.
4 lbs. parsley.
¼ lb. white pepper.
75 lbs. rice.

Place in kettle after chicken is removed; add rice and boil for 25 minutes.

Pack hot into jars and seal.

Chicken Gumbo Soup.

50 gals. chicken soup.
50 lbs. chicken meat.
50 lbs. lean ham.
50 lbs. canned okra.
30 lbs. canned tomatoes.
6½ gals. water.
1 oz. cayenne pepper.

Cut the ham in dice shapes, place in kettle, cover with water and cook 45 minutes; add all the other ingredients, bring to boil.

Pack hot in jars and seal.

Mulligatawney Soup.

100 lbs. chicken.
2 lbs. sliced onions.
2 lbs. butter.
1 lb. salt.
1 lb. curry powder.
2 ozs. whole cloves.
1 doz. lemons (juice of).
20 gals. water.

Clean the chicken and cut in small pieces. Put the butter in an iron pot, with the onions and chicken, and brown.

Add the curry, salt, cloves, and lemon juice. Place this mixture in kettle with cold water; bring slowly to a boil; simmer 2 hours; then take out chicken, divide among jars, fill with hot liquor and cap and process.

Mulligatawney may be made from the regular chicken soup by adding 40 lbs. cooked chicken meat, juice of 2 doz. lemons, 8 lbs. of onions browned in grease, and 2 lbs. curry powder to 100 lbs. of soup.

Other Chicken Products.

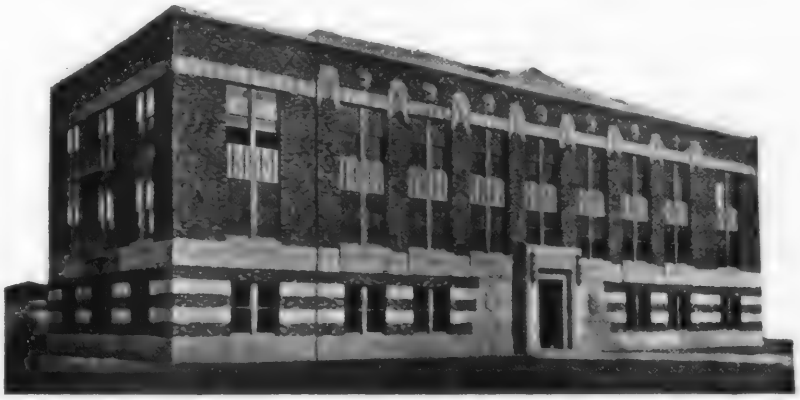
Chicken Liver Paste.

Livers, hearts, and gizzards are cleaned in 1 quart of water and 1½ ozs. of salt—to which are added about a dozen whole cloves and an equal number of bay leaves. The whole is boiled until the meat is tender; the meat is removed and chopped very fine, making a paste by adding 9 tablespoonfuls of chicken butter, adding a little white pepper.

This is packed in C-2 and 304 jars and processed for 45 minutes at 240° F.

Regulations in U.S.A.

It is interesting to note that in U.S.A. the canning of meats, or a product in which meat is a constituent, if intended to be offered in inter-State traffic, can be conducted only with a permit from, and the approval of, the Bureau of Animal Industry. That Bureau prescribes the sanitary conditions which must be fulfilled in the establishment, appoints the inspectors, and makes the regulations for the conduct of the work. These are far more stringent than those applied in any other line of canning. Some States have enacted laws similar to the Federal laws to apply to foods for local consumption, hence the necessity for becoming familiar with all requirements before attempting packing this line.



The New Fish Products Research Laboratory of the Bureau of Fisheries, U.S. Dept. of Agriculture, situated at Seattle, on the Pacific Coast.

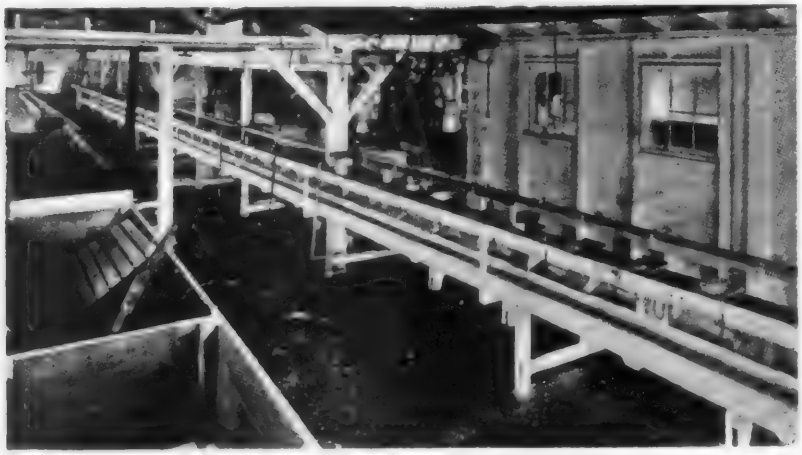
Fish Research in U.S.A.

A REPORT recently issued by the Bureau of Fisheries, U.S. Department of Commerce, reviews the investigations carried out by that body. In this report it is stated that fisheries technology covers a very wide field of activity, in that it deals with an important food industry and sources of valued products in the arts and industries. The study of the technology of many food industries is an extensive subject and few, if any, food industries are as highly diversified as the fishery industries. Fisheries technology is at present demanding the attention and best efforts of chemists, engineers, and bacteriologists. Until a few years ago little had been accomplished in this field of technology. Much remains yet to be accomplished. The Bureau of Fisheries, the College of Fisheries of the University of Washington, Seattle, Wash., and some of the larger fishery companies have been the leaders in this field. Developments have come very rapidly in recent years. The technical handling, preservation, and distribution of foods through the medium of refrigeration, particularly to inland consumers, has been largely a result of research activities in fisheries technology. Great progress has been made in the elimination of waste in the fishery industries. The enormous strides in the manufacture and uses of marine by-products are a real contribution to the science of animal nutrition. In fact, progress in some branches of fisheries technology, described in detail in the report, has been so great that other food industries are looking to this industry for guidance.

During the past year the Bureau's technologists completed an extended study of the menhaden industry and arrived at a number of important conclusions, which are summarised in the report.

Work has also been done in devising methods for conserving as near as possible the original vitamin potency of fish oils. Another line of investigation led to the conclusion that salmon oils extracted from the canned offal are rich in vitamins A and D, and the suggestion is made that these may replace cod liver oil.

A Modern Fish Wharf, Smoke-House, Freezing and Cold Storage Works erected last Year at Vancouver, B.C.



Cleaning and Inspection Table in a Californian Cannery.

The fish are automatically counted as they go on to the conveyor belt.

During the past year experiments have been conducted on freezing oysters, which have demonstrated the fact that they can be rapidly frozen and placed in cold storage for several months without impairing the taste.

Measurements have been made of the amount of mineral constituents of food value that are leached out of fish when packed in ice. In preliminary experiments it was found to be as high as 4 lbs. per ton over a period of seven days.

The Bureau has established a large field laboratory at Gloucester, Mass., for the general conduct of technological research, including the following activities: refrigeration, smoking, canning, bacteriology of industrial processes, by-products, and production methods. The work concerns mainly the fishery industries of the Atlantic coast. The present by-products programme includes studies of haddock liver oil, and a comparison of fish meal and oil manufacturing methods with a view to developing improved methods. Haddock liver oil is being subjected to biochemical tests at Washington, while fish meal produced in various ways is being tested on chickens at an Ohio agricultural experiment station. This work is in the initial stages, but much valuable information is expected to result.

No arrangements have yet been made for technological research at the new Seattle laboratory, but it is hoped that research on a number of problems peculiar to the Pacific coast will be undertaken there in the near future. We are indebted to the *Pacific Fisherman* for the illustrations shown in this article.

FOOD MACHINERY (M. AND P.) LTD. is the title of the new amalgamation between Mather and Platt Ltd. and the Food Machinery Corporation California. Mr. Ogden Sells, who is at present in England, will be a director. The Mather and Platt factory in Manchester and sales organisations throughout the whole world will be available to the new company. Further details in our next issue.

An "All-British" Food Push

FROM May 21 to June 4 this year Olympia is to house the "Nation's Foods Exhibition"—the first of its kind which has ever been held. Its object is to demonstrate the possibilities of Great Britain and the Empire with regard to food production. Organisation of the exhibition is being undertaken by the Greater London Grocers' Council, and every part of the overseas dominions will be represented by food products. In order to stimulate interest, special "days" during the exhibition have been allocated to the various participating countries, and on these days the opening ceremony will be performed by the appropriate High Commissioner or other representative. Thus, Saturday, May 28, is Canada's day, and two days (May 23 and June 3) have been set aside for Great Britain and Northern Ireland. June 3 is to be England's day.

These, naturally, are the two days in which our readers are most interested, and on the first (May 23) special co-operation will be given to the Ministry of Agriculture and Fisheries in support of the National Mark campaign, as applied to the grocery and allied trades. England's day, June 3, will be devoted to special prominence and publicity for all English products, manufactures, and merchandise. On Empire Day the promoters are co-operating with the Fellowship of the British Empire in their campaign for "Empire Meals on Empire Day." British canners and packers under the National Mark scheme should make a special point of linking themselves up with the arrangements for these days. Special window displays of exhibitors' goods and products will be made by retail grocers throughout the kingdom, under a window dressing prize scheme organised by the exhibition authorities, and the whole event should result in a previously unrealised amount of publicity and attention being focussed on home and colonial foodstuffs.

Bacteriology in the Canning Factory

By T. CROSBIE WALSH, F.I.C., F.C.S.

THE PATH of the vegetable and meat canner is beset with traps of various kinds; that of the fruit canner less so, thanks to the blesséd virtues of *p*H.

The possibility of the acquirement of increased resistance to heat of a fairly ubiquitous organism is apparently not commonly known, and the phenomena to be described may serve as a reminder to existing and prospective canners to adopt with due reserves the "cookery book" type of recipe for his canning operations.

The bacillus isolated from a blown can of meat had the following characteristics:

Peretrichic flagellation. Vigorously motile rods 0·8 to 1 μ wide and 3 to 8 times as long. Rods straight, others slightly curved, alone and in pairs. Spores were terminal or sub-terminal. Free spores numerous and were 3 μ long and 1½ μ wide. The spores tended to swell the body of the bacillus and formed granules in sugar media. The bacillus was gram positive even in old cultures, this differentiating it from *B. Saccarobutyricus* v. Klecki and the many other forms said by Bredemann to be identical. *B. putrificus* (coli) Bienstock has been found by Kimura (*Centralblatt für Bakteriologie*, 92, 342) to resist heat in brain media for over 5 hours, and in this respect the bacillus in question has similar characteristics. The possibility of *B. putrificus* cultures being mixtures will not be discussed in this article. Optimum temperature 37° C. Between 20° C. and 30° C. growth is very slow, and below 20° C. almost nil. Strict anaerobe. Growth in ordinary agar and gelatine culture and peptone bouillon media very slow, but in the presence of glucose copious growth is obtained in 24 hours at 37° C.

Glucose agar in 24 hours, small round blueish colonies, irregularly bordered. Gas is soon produced, breaking up culture medium. Gelatine glucose: formation of gas and liquefaction in 9 days. No growth on potato. Milk coagulates in 40 hours and peptonisation occurs in 110 hours. Sucrose and mannite (but not lactose or dextrose) attacked with copious gas formation.

The spores resisted live steam for over 5 hours, but were killed in 5½ hours. This was found in glucose agar cultures and in cans of meat infected with pure cultures.

During the investigation of this bacillus, Bordoli demonstrated the comparative ease with which he was enabled to modify the heat-resistant powers of spores. He effected this by a series of semi-sterilisations.

The writer has, on several occasions during the past few years, carried out investigations on the intensification of heat resistance on the lines suggested by the experiments originally made by the above-named investigator. From a long series of plates pure cultures were obtained and subjected in canned meat, meat paste, and glucose agar tubes to a treatment of 2 hours at 98° C. The contents were seeded out into sterile meat, meat paste, and glucose agar. It was found that the thermal death-point had been raised one hour approximately. The above operations were repeated until the resistance of the spores had been raised from under 5½ hours to over 11 hours

Here is a case in which the presence of such organisms would have rendered useless a "cookery book recipe," for the usual sterilisation would have failed. Probably (and happily) this is a rare case, but one of which canners should not ignore the possibility, especially the canner of meat, peas, and vegetables.

The author was able, whilst working with the strain of bacillus described above, to demonstrate its very marked sensibility to sodium chloride. The original culture which resisted over 5 hours' sterilisation was present in a meat product containing 2·75 per cent. sodium chloride.

When the salt content was raised to 4 per cent. it was found that complete sterility of the product was attained after 2 hours.

It is obvious that the smaller canning factories are not able to maintain a bacteriological laboratory of their own, although they are now able to refer their problems to well-organised and competent research stations. But there is the inevitable delay involved in sending the samples and receiving the results, and also the natural difficulty of interpreting such results with special reference to the local conditions of the factory. Tracking down the source of micro-organisms may prove a long job—in so many guises do they lurk.

In looking for causes of trouble, the canner will obviously satisfy himself regarding his seaming. He will remember that seam strength may be adequate under one set of conditions and not under another. Raw material even slightly delayed *en route* to the can under adverse meteorological conditions may suffer from incipient fermentation, not always detected by casual inspection. The result of certain types of fermentation will be the evolution of gases during sterilisation and consequent stretching of seams.

The canner should set aside representative samples at short intervals during the day and subject them to incubation in a convenient chamber which is capable of being maintained at a fairly constant temperature of from 37° to 42° C. He should arrange to have his cans marked with a hieroglyphic indicating the exact day of manufacture. In conjunction with this identifying mark, a system of records should be adopted. In these records, every possible bit of data regarding conditions which might in any way affect the pack should be tabulated, such as maximum and minimum temperatures, hygroscopicity, state of raw material, source of raw material, delays, etc.

Such records have been found in actual practice to be invaluable in tracking down causes of complaints as to quality and in gaining an increased understanding of the multitudinous and sometimes variable influences upon the nature of the pack. They will help the canner to improve it and maintain those undeviating standards which are all important factors in gaining and keeping the confidence of the consumer of canned goods.

Crab Canning Problems

ONE OF the most important developments in the Japanese canning industry during the past thirty years has been that of canning crab meat. The species of crab commonly canned in Japan is *Paralithodes camtschatica* (Tilesius). There are now produced about 500,000 cases of this product annually, valued at approximately £2,000,000. The crab canning industry is located in the northern part of Japan and along the Siberian coast. More than one-half of the production of this commodity is exported to the United States.

Since the beginning of this industry, considerable difficulty has been experienced with chemical changes occurring in the crab meat after being canned. One of the most important of these changes is the blackening of the meat. This problem was first studied about twenty-five years ago, when one observer added an organic acid to the contents of the cans of crab meat to prevent this tendency to discolour. Later, Okuda and Matsui (1916) published the results of some experiments conducted by them, in which an effort was made to prevent this discoloration or blackening. This problem has also been studied by Harrison and Hood (1923), Dill and Clark (1926), and Reed and MacLeod (1924), and their reports have been published in Canadian and American publications.

More recently the problem has been taken up by Kokichi Oshima, of the College of Fisheries, Hokkaido Imperial University, Japan, and the results of his investigations are embodied in *Investigational Report No.* 8, U.S. Department of Commerce, Bureau of Fisheries, 1931.

The conclusions arrived at by Kokichi Oshima are given as follows:

(*a*) *Double-Lacquered Cans.*—When these cans were properly lacquered, the contents were found to be in very good condition. There was seldom any blackening, even without the addition of the buffer solutions.

(*b*) *Single-Lacquered Cans.*—Without the addition of the buffer solutions, the condition of the meat was generally good. In some cases where the meat was bad, blackening had occurred. The addition of buffer solutions almost completely prevented the blackening, and in those cans to which had been added sea water or 3 per cent. common salt solution, the blackening was even less noticeable.

(*c*) *Plain Tin Cans.*—The meat in these cans was bad, often showing blackening and rust, even in those treated with a buffer solution. Those treated with sea water or 3 per cent. salt solution showed a great improvement.

The most efficient of the buffer solutions in retarding the increase of *p*H value was the sodium phosphate; the tartrate solution ranks next in efficiency; while the citrate was the least desirable. The taste imparted to the products treated seemed to be in reverse order to the above—that is, the phosphate gave the most noticeable taste, the tartrate the second in taste, and the citrate the least noticeable. The mixtures which will be recommended for practical application are tartrate, citrate, or citrate and phosphate mixtures. The concentrations which gave the best results were 10 c.c. of 1·5 normal tartaric acid and 8·5 c.c. of 1·5 normal sodium hydroxide; the *p*H value of this mixture is 5·8. For the treatment of ½-lb. cans, 10 to 20 c.c. of the mixture were added to the contents. The two following solutions have a *p*H value of 6·0: 10 c.c. of normal citric acid and 8·8 of normal sodium hydroxide; 5 c.c. of M/3 mono-basic-sodium phosphate and 1·7 c.c. of M/3 di-basic-sodium phosphate. These two solutions can be used in equal parts or the citrate solution can be used alone.

These acids are not strong enough to affect the taste of the meat. Neither does filling the cans with sea water or common salt solution influence the taste, but this does cause a slight softening of the meat. Sometimes blackening occurs on that part of the meat which the juice does not reach. Therefore, the method of filling the can entirely with sea water or 3 per cent. salt solution is recommended. As shown by the above results, the use of buffer solutions and sea water or diluted common salt solution helps to prevent the blackening appreciably, even when the coating of the can is not suitable.

United States Patent No. 1686393, dated October 2, 1928, has been granted to the author for this process. This patent is being assigned by the author to the United States Bureau of Fisheries for the use of the American industry.

"Blue Meat."

Another important problem facing this industry, which has been given very little attention up to the present time, is the cause of "blue meat" (blue spot or blue point). After developing the process for overcoming the blackening, almost completely, this question was also given considerable study. The "blue meat" and the blackening of crab meat are very much alike in appearance, and in some cases it is very difficult to distinguish between the two. In Oshima's opinion, they can be defined as follows: The cause of "blue meat" originates in the meat itself, whereas blackening is caused by contact of the meat with the metal of the can.

Many experiments were made for the prevention of "blue meat," but few were successful. The most successful method was the treatment of the meat with sodium tartrate, tartaric acid, and sodium chloride. It is certain that "blue meat" is caused most frequently when the canned crab contains some crab blood. Therefore, it is considered advisable to wash thoroughly the blood out of the crab before canning.

It is also found that the blue meat can be decolorised by cooking with concentrated solutions of potassium nitrate or diluted inorganic acids. Some crabs develop "blue meat" while they are still alive; and also after being killed and before they are cooked. This cause, therefore, seems quite difficult to explain. It is the suggestion of Oshima that this subject be given more attention by scientists.

The Bacteriology of Common Salt

By WILLIAM CLAYTON, D.Sc., F.I.C.
Chief Chemist and Bacteriologist to Messrs. Crosse and Blackwell, Ltd.

A series of articles reviewing present knowledge in relation to the bacteriological action of salt. Part V. will deal with the brine fermentation of vegetables for pickles, and Part VI. with the salting of butter and margarine.

PART IV.—THE REDDENING OF SALTED FISH

RED DISCOLORATION on dried salted fish such as cod is more common than generally recognised, and the phenomenon is termed "pink" or "pink eye." It has been known for about fifty-five years, and various investigators have from time to time studied the question, which is essentially a bacteriological one. In spite of the several published accounts of the bacteriology of the phenomenon, general agreement has not been reached, for reasons to be made clear later.

The early work of Le Dantec,* Layet,† Farlow,‡ and others have been described by Cloake,§ whose monograph should be consulted as an introduction to the subject. In brief, these earlier investigators concluded that the origin or the red colour on dried salted fish was the use of solar salt—*e.g.*, Mediterranean sea salt. Thus, Farlow reported that the reddening was due to *Clathrocystis roseo-persicina*, an alga isolated from Cadiz solar salt. Dispute arose regarding the pathological nature of red fish, some authorities believing that certain spasmodic outbreaks of gastro-intestinal disturbance following the ingestion of salted red fish were due to the special bacterial halophilic flora present. Others attributed such illness to incipient putrefaction. However, the general results of later investigations definitely point to the innocuity of reddened fish.‖

Various types of micro-organisms have been isolated from salted red fish. Eddington¶ isolated *B. rubescens*, Harrison and Kennedy** *Pseudomonas salinaria*, Cloake two organisms—a "red coccus" (occurring in coccus and sarcinal growths) and an unidentified organism assuming quite remarkable shapes, apparently due to polymorphism. Incidentally, apparent polymorphism is practically always observed with organisms associated with high salt content, but involution forms cannot be excluded as an alternative explanation.

During the past ten years the present writer has examined hundreds of samples of salt (solar and British), sea-water, and salted fish. By far the most common type of organism isolated in halophilic studies is the micrococcus, usually seen under the 1/12 oil immersion lens as extremely minute dots. Peculiar involution (or polymorphous) forms abound. No sample of solar salt has been examined which has failed to yield red or pink growths on media saturated with NaCl. If fish is salted with such salts reddening invariably occurs, whilst fish salted with salt prepared by evaporation of brine at elevated temperatures always cures free from red discoloration.

Accordingly, the first stage of an enquiry into "pink" concerns the origin of the halophilic strains associated with solar salts. Sometimes one can easily see red colonies on the dry salt crystals themselves. Particularly is this the case with Indian solar salts.

Solar salt is prepared by the evaporation of sea-water in artificial lagoons under solar radiation. Organic matter—*e.g.*, seaweed—is present and the temperature rises to about 35° C., conditions very favourable to the growth of bacteria. The primary question now arises as to whether common types of bacteria are sorted out according to their increasing tolerance for NaCl. Certain fresh-water bacteria are able to survive in sea-water for a considerable time and in some cases to acquire salt tolerance (Burke and Baird).* Also fresh-water bacteria can decompose organic matter in sea-water.

Lipman,† working at the Tortugas Laboratory, Florida, has shown that bacterial populations in the open sea are very small, scarcely ever showing more than 150 organisms per c.c. of sea-water. Usually the numbers are much smaller. Korinek‡ has made a study of the decomposition processes of organic substances in the sea, and finds that in the sea, even in close proximity to land, organic matter is decomposed by marine bacteria. Fresh-water bacteria which reach the sea by means of rivers are of no importance in this connection. In the mixtures of sea and fresh water a bacterium always develops, which finds its optimum in the given concentration of salts; others are inhibited. The soil bacteria have their optimum in fresh-water; those of sea mud in sea-water. Sea micro-organisms are very sensitive to fresh-water: those of fresh-water are not so sensitive against sea-water.

One is forced to the conclusion that solar salt acquires its peculiar bacterial halophilic flora by the

* *Annales de l'Institute Pasteur*, **5** (1891).
† *Bulletin U.S. Fish Commission*, **7**, 90 (1887).
‡ U.S. Commission of Fish and Fisheries: *Commissioner's Report* 969 (1878).
§ Dept. Sci. Ind. Research: Food Investigation Board. *Special Report* No. **18** (1923).
‖ *Cf.* Hanzawa and Takeda, *Arch. Mikrobiol.*, **2**, 1-22 (1931).
¶ *Ann. Reports of Fishery Board for Scotland*, **6**, Appendix 204 (1887).
** *Trans. Roy. Soc. Canada*, **16**, 101-152 (1922).

* *J. Bact.*, **21**, 287-98 (1931).
† Carnegie Inst., Washington, *Publication*, **391**, 231-248 (1929).
‡ *Biochem. Zeitschr.*, **192**, 230-237 (1928).

acclimatisation of sea-water strains. Such forms evidently resist pronounced desiccation, and, in this connection, the present writer has grown luxuriant red cultures on NaCl-saturated media from dried salted Indian fish five years after desiccation. An almost unexplored field of research is open in this connection. What are the organisms which, initially present in sea-water, later demand saturated NaCl conditions for growth? Can this halophilic character be reversed? If sea-water is concentrated *in vacuo* at low temperatures, will the salt so recovered bring about "pink" on fish after curing? Is there a *p*H range wherein solar evaporation of sea-water will produce a salt free from the red organisms? If sea-water was filtered from organic matter and was then evaporated under solar radiation, not in lagoons but in sterlised metal tanks, would the salt still have red organisms? None of these questions are yet answered.

The present writer believes that there is an alternative explanation, or, maybe, an additional explanation. Air-borne micro-organisms may possibly play a rôle in this matter. The marked sorting-out of micro-organisms of the air by culturing on media of different NaCl content suggests that the peculiar conditions obtaining in the solar salt lagoons permit the development of salt-tolerant strains independent of those in the original sea-water.

So far as the present writer is aware, red salted fish never occurs when British (brine-evaporated) salt is used. With solar salt, immunity from "pink" can be gained by stoving the salt at 120° C. for thirty minutes. Cloake found that the addition of 5 per cent. of sodium bisulphite to the salt prevented "pink." To free a curing establishment from red infection, Harrison and Kennedy recommend treating all material which has come into contact with solar salt or pink fish with live steam. All utensils should be washed with water containing 2 per cent. sulphurous acid.

Recipes for Pickles

BY JOHN ELSBURY

1. Brining and Pickling.

Make up a brine of 2½ lbs. of good salt to each gallon of water, and see that all the salt is dissolved. Place the onions in a clean 50-gal. cask, the amount being 3 to 4 cwt., depending on their size. Head up well, pour in sufficient brine to fill the cask, and lightly bung. Allow to stand and ferment for 14 days. Then run off the brine.

Make up another brine solution of the same strength as the first. Add to the onions in the cask 1 oz. of benzoate of soda. Pour in the second brine solution and allow to stand until fermentation has ceased. Run off the brine and wash the onions well with clean, hot water to remove all benzoate of soda.

Now place the onions in diluted acetic acid made up in the proportion of 1 gal. of 80 per cent. acetic acid and 18 gals. of boiled water. Allow to stand 48 hours, after which they are ready to fill.

2. The Silver Onion.

Prepare a brine as directed in recipe No. 1. Place the onions in the 50-gal. cask, and to them add 1 oz. metabisulphite of potash. Pour on the brine and ferment for about 14 days. Then run off the brine.

Make up another solution of salt of the same strength as the first. Pour this into the cask of onions and allow to stand until fermentation has ceased. Run off the brine and wash the onions well with boiling water.

Then add the acetic acid and water mixture (1 gal. of 80 per cent. acid to 18 gals. of water). Stand for 48 hours, after which bottle and pickle with white mustard seed and French white wine vinegar or acetic acid and water.

Dried Soups

READERS are advised to look out for an important article shortly to be published on the manufacture of soup cubes, powders, etc.

Vinegar Manufacture

ANOTHER forthcoming article describes the most up-to-date processes for the manufacture of vinegar.

Fruit Juices

PROFESSOR CRUESS is touring the Californian factories and is preparing for us an article on the manufacture of citrus juices.

Special Features

AN interesting series of photographs of the interior of a modern English factory engaged in the canning of cream will appear in the next issue. They have been specially taken for FOOD MANUFACTURE.

Arrangements have also been made for articles on cereal food preparations, the German methods of manufacturing cocoa powder, milk and whey foods, and other equally important subjects.

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Sardine Canning in Britain

The following account of a fish canning factory situated in this country, which is equipped with the latest plant and machinery, is of special interest at the moment.

DURING PAST years many have played with the idea of initiating sardine canning in this country on modern lines, similar, for instance, to what is now established practice in Norway, but until quite recently there has been little or nothing done in putting the idea into practical form. Now, however, it does appear fairly certain that before many months have passed we shall see the beginnings of what will eventually develop into an industry of considerable dimensions.

A British Example.

Few people realise that we have already in this country one of the most up-to-date and efficient fish canning establishments in the world. The plant and machines are of the latest type; it is true they are of Norwegian and French origin, but this only serves to emphasise the further scope there exists for British enterprise in the construction of fish canning equipment; at present there is an open field for progressive engineering firms. The fish canning establishment to which we refer is the Norseland Canning Co., Ltd., which, although mainly engaged on the canning of brisling, sild, sardines, and herrings and other fish, also operates on canned peas and beans. The concern has an average output on brisling and sild sardines of 60,000 to 70,000 tins a day, using over a million fish a day and employing some 250 hands. The credit for this fine achievement is almost entirely due to the indomitable courage and energy of one man, the managing director of the firm, Mr. C. W. Banks, who has built up the business step by step from its modest beginnings in a back shed some eighteen years ago. Incidentally, Mr. Banks confesses to have learned something about the "snags" of fish canning, but he, at any rate, has proved that whatever "snags" may exist they are capable of being overcome if one is endowed with a fair share of grit.

The factory of the Norseland Canning Co. is situated in Leeds. At first sight this appears to be the wrong place for a fish canning factory, but the reason for this choice will be understood when one considers the movements of the shoals off our coast. At certain periods of the year the fish may be caught off the west, east, and south coasts of England; at others, off the north-west coast of Scotland, the south coast of Ireland or the Belgian coast, and so on. Leeds is centrally situated with regard to the various points of catch, and allows the fish to be delivered to the factory in, on the average, the shortest possible time. Within three to twelve hours after being landed at any port the fish is in the factory. Transport is by passenger train and motor haulage, the fish being conveyed in small, flat boxes in which they are carefully packed with ice.

Processing the Fish.

On arrival at the factory, the fish are washed and cleaned by machinery, and then passed through brining tanks. The fish are next placed on tables where girls, by the aid of small machines fixed to the edge of the tables, quickly thread them on to rods, passing the latter through the eyes (Fig. 1). Each rod takes about twenty-two fish, and when thus loaded it is placed on a frame, as shown in the photograph; each frame carries about twenty-five rods. During this process the fish are sorted into larger and smaller sizes.

FIG. 1.—Washing, Brining, and Rodding the Fish.

FIG. 2.—Smoking the Fish.

The next stage is "smoking" (Fig. 2), whereby the moisture is driven off and the flavour and silvery sheen imparted to the small, delicate fish. For the drying-smoking process oak logs are used and bright hot fires are maintained. There are twelve ovens, and through each of these 10,000 fish pass every hour.

The frames of fish are next brought to the head cutting machine (Fig 3), which decapitates them at

FIG. 3.—Head Cutting Machine and Packers' Conveyor.

FIG. 4.—Battery of Automatic Oiling and Tomatoing Machines.

the rate of 100 fish per second. Working in conjunction with this machine is a conveyor attachment which automatically conveys the beheaded fish on trays to the packers, who pack the fish in tins according to size and return the empty trays for refilling. The offal is used for the preparation of fertiliser, poultry food, etc.

The packed tins, after careful inspection by girls specially qualified for the purpose, are carried to a battery of automatic oiling and tomatoing machines (Fig. 4), which fill the tins with a measured quantity of either pure olive oil or tomato sauce.

After this the trays of tins are carried to automatic hermetical seaming machines (Fig. 5), which work at a speed of 2,500 tins per hour. The lids are doubled seamed on to the tins, no solder being used. From these machines the tins now fall on to a conveyor which takes them to the sterilising retorts for cooking under high temperature and pressure. The tins are loaded into baskets which are lowered by crane into the vertical pressure retorts and there processed for the required time. When cooled they are then emptied into baskets which pass through an automatic washing machine, where they are thoroughly cleansed by boiling water and soap powder. From here they pass through a bath of clean, boiling water and into a hopper, which feeds them on to a slow conveyor passing through a hot-air drying chamber which thoroughly dries the tins.

The dried and polished tins are then taken by another conveyor to a three-storied warehouse, where girls quickly place the tins in cases specially made to hold exactly 100 tins.

The filled cases are then stacked and warehoused, and wrapped, keyed, and labelled on issue to the labelling department, according to customers' re-

FIG. 5.—Hermetical Sealing Machines.

FIG. 6.—Tin and Lid Making Plant.

quirements. The company maintains a stock of nearly 10,000,000 labels of some twenty different designs.

As a further indication of the complete equipment which the company possesses, readers will be interested to hear that the Norseland Co. makes its own printed cases for the packed tins as well as the tins and lids themselves. These last are made by a battery of ten deep-drawing stamping presses (Fig. 6) with self-trimming dies, which produce the deep-drawn tins from the flat metal sheet, the stamping, drawing, and trimming being done in the same operation. In another department five automatic machines apply the "gummi-rings" by heat to the tin lids. A baling machine is installed for the purpose of compressing the scrap from the stamping presses, thus simplifying the quick despatch of the waste to the detinning works. The mechanics' shop is well fitted and contains a stock of self-trimming dies capable of producing more than a dozen different shapes and sizes of tins and their corresponding key opening lids.

The Preparation of Yeast

IN the preparation of yeast, the choice of the nitrogen-containing nutrient is of great importance. Many investigators have carried out experiments using different materials, while fundamental work on this problem was done in 1908 by Henneberg. Experiments are now described by Claassen (*Zeit. f. angew. Chemie.*, 1932, p. 80), in which the effects of different nitrogen-containing nutrient media are studied in detail. The conclusions are: (1) Other conditions being equal, in the preparation of bakers' yeast, equal amounts of assimilable nitrogen of different kinds give different yields, albuminoid content, and yeast quality. (2) The yield given by adding ammonia nitrogen to a nutrient solution is smaller than that produced by an equal amount of assimilable organic nitrogen. Of the latter type, the amino nitrogen in the solution of decomposed albuminoids is more favourable in effect than that in malt extract. The albuminoid content of the yeast is most affected by ammonia nitrogen and least by the addition of amino nitrogen. (4) The yeast absorbs less nitrogen from nutrient media which contains more ammonia nitrogen, than from one containing nitrogen in the organic form. This point is emphasised, because, during vigorous fermentation, the yeast removes more of the ammonia nitrogen than the organic nitrogen. If the sugar is fermented the yeast exhibits preference for the organic nitrogen. (5) If the yeast is prepared in the presence of ammonia nitrogen, its stability is less and fermentation processes take longer than when organic forms of nitrogen are used. The nitrogen in malt has the most favourable effect on the quality of the yeast. (6) Strong aeration acts very favourably on the yield. This effect, however, is less evident when ammonia nitrogen is present, and very positive when the nitrogen is in the form of decomposed albuminoids.

This work confirms Henneberg's findings that the nutrient medium used for the cultivation of yeast should contain a sufficient quantity of assimilable organic nitrogen and some ammonia as assistant. This question of correct nitrogenous nutrient is as important as the *p*H control and the selection of pure cultures. It is true that the use of ammonia results in good yields of yeast suitable for bakeries, but such yeast is not so stable and uniform in quality as many bakers now demand. Works practice has confirmed the fact that improved results are obtained by using ammonia nitrogen in addition to, and not as a substitute for, organically combined nitrogen.

The Role of Acidity in Food Preservation

By PROFESSOR W. V. CRUESS
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Vegetables of low acidity such as peas, corn, and asparagus are very difficult to sterilise at 212° F.; usually temperatures of 240° to 250° F. are necessary in industrial practice. These high temperatures affect the flavour and texture somewhat adversely.

When canned in brines acidified with citric or acetic acids (or with lemon juice or vinegar) so that the final pH value after canning and processing was pH 4·8 or less, it was found in the author's tests that the products did not spoil even when heavily inoculated with heat-resistant bacterial spores before canning.

The acidified brine method is in successful commercial use in California for one vegetable —namely, artichokes. With proper chemical and bacteriological control, and with the supervision of Government food authorities, the method might be safely extended to certain other vegetables.

PART I

IT HAS long been recognised by canners that foods of high acidity, such as apricots, peaches, plums, tomatoes, and fruit juices, are much less difficult to sterilise than foods of low acidity, such as meats, peas, spinach, and asparagus. Until relatively recently, however, quantitative studies were not made to determine the effect of acidity on the time and temperature required for the sterilisation of various food products and the relation of acidity to the temperature and time required to kill micro-organisms responsible for food spoilage. A number of investigators, including those in this laboratory, have proved during the past few years that there is a definite correlation between the active acidity—that is, the hydrogen ion concentration, and the resistance of bacteria to heating. Still more recently it has been demonstrated by research conducted in this laboratory that the concentrations of such food preservatives as sodium benzoate, sulphurous acid, salicylic acid, and acetic acid, required to inhibit growth of micro-organisms in food products vary greatly with the hydrogen ion concentration.

The two problems, first the effect of hydrogen ion concentration on the sterilisation of foods by heat, and, second, the effect of hydrogen ion concentration on the preservation of foods by chemical agents will be presented in this report.

Effect of *p*H Value on the Sterilisation of Foods by Heat

Brief Explanation of pH Value.—The sour taste of fruits is due to hydrogen ions given off by the naturally occurring fruit acids. Acids in solution in water dissociate chemically to give concentrations of hydrogen ions that depend upon the nature of the acid and its concentration. At equivalent concentration, hydrochloric acid gives a very much greater concentration of hydrogen ions than does acetic acid. In other words, hydrochloric acid is a strong acid and acetic a weak one.

Foods vary greatly, not only in their total acid content, but also in their hydrogen ion concentration. Thus, gooseberries have approximately 100 times as great hydrogen ion concentration as pumpkin, and about 2,000 times as great as corn. In other words, in gooseberries, the hydrogen ion concentration is approximately ·01 grams per litre and in corn about ·0000005 grams per litre. A more convenient form of expressing these numbers is as *p*H values. The *p*H value is defined by the expression $pH = \log \frac{1}{H+}$; it is the logarithm of the reciprocal of the hydrogen ion concentration.

Thus, if

H+ = ·001 grams per litre.

$pH = \log \frac{1}{\cdot 001} = \log 1{,}000 = 3$; or the *p*H value in this case is 3.

It is merely a means of expressing values in powers of 10—thus giving small whole numbers in place of long decimals.

Water is neutral—*i.e.*, it has as many hydrogen ions as hydroxyl ions, the latter being given off by alkalis such as sodium hydroxide. The *p*H value of water is 7. Values above 7 indicate an alkaline condition; values below 7 an acid condition. At *p*H 3 the hydrogen ion concentration is 10 times that at *p*H 4, 100 times that at *p*H 5, and 1,000 times that at *p*H 6.

Throughout the remainder of this paper we shall use the term "*p*H," instead of the longer term, "hydrogen ion concentration." It must be remembered that the lower the *p*H value, the higher the hydrogen ion concentration; in other words, *p*H *is not a direct* function, but is an inverse or "upside down" one.

The pH Value of Fruit and Vegetables.—Most fruits are naturally quite acid in reaction and possess *p*H values below 4·2. Figs, however, are of higher *p*H value, well above 4·5 in most cases, and therefore difficult to sterilise by heat. California canning peaches, pears, and apricots are in the neighbourhood of *p*H 3·9 to 4·1. Berries are usually below *p*H 3·6. Tomatoes in this State are usually about *p*H 4·2 to

4·3. The non-acid vegetables such as asparagus, string beans, corn, spinach, etc., are usually well above *p*H 5·0 and on this account favourable media for heat-resistant spore-bearing organisms; likewise, they are difficult to sterilise by heat. The critical *p*H value, above which foods are difficult to sterilise by heat, is about *p*H 4·5. Most fruits fall below this value, most vegetables rise above it.

Review of Literature.—Experiments conducted by Cruess in 1913-1915 and reported briefly in Circular 158[1] of the College of Agriculture of the University of California in 1916 showed that peas, string beans, pumpkins, beets, turnips, artichokes, and asparagus canned in brine acidified with 4 to 6 ounces of lemon juice per gallon and processed one hour at 212° F., kept perfectly for an incubation period of more than a year, while the same vegetables canned in the same manner but in non-acidified brines spoiled. The samples were not artificially inoculated with heat-resistant organisms, but the fact that the non-acidified checks spoiled showed that such organisms were present naturally.

Dickson,[2] Burke, and Ward conducted experiments in 1917 and 1918 on the effect of acidified brine on the growth of *B. botulinus* and on the destruction of its spores by heat in canned vegetables. Their conclusions are summarised in the following quotation:

"Our first series of experiments show beyond all doubt that when exposed to brines containing lemon juice in the amount of approximately 5 per cent., a virulent toxin is developed under favourable conditions of temperature. But when the spores are exposed to the action of boiling water for one hour in acid brines of similar concentrations, as in the method of canning recommended by Cruess or in a mixture of lemon juice of more than 2 per cent., as in our preliminary experiments, the spores are completely destroyed."

Their control samples, not acidified, but heated for one hour in boiling water, developed growth of *B. botulinus* and a strong toxin. While the acid of the lemon juice did not prevent growth in the unheated juice, it greatly decreased the resistance of the spores to heat.

Skinner and Glasgow[3] report that the addition of two tablespoons of vinegar of 4·4 per cent. total acid (as acetic) per quart of brine used in canning asparagus greatly reduced the time necessary for sterilisation at 100° C.

Weiss[4] determined the effect of *p*H value on the death point of the spores of a strain of *B. botulinus*. In citric acid of a *p*H value of 3·16 (2·1 per cent. acid) the spores were killed in less than 10 minutes at 100° C., while the time required at *p*H 6·66 (nearly neutral) was 90 minutes.

The same investigator[5] found that the spores of *B. botulinus* were killed at 100° C. in eleven different food juices having a *p*H range of 2·1 to 3·81 in less than 50 minutes, in 60 to 90 minutes in those of *p*H 4·22 to 4·4, in 90 to 120 minutes in those of *p*H 5·13 to 5·26, while those of *p*H 5·69 to 6·21 required 150 to 180 minutes.

Using spores of thermophiles that are extremely resistant to heat, Bigelow[6] and Esty determined the death times in juices expressed from various commercially canned vegetables at 100°, 110°, 115°, and 120° C. The time necessary to kill the spores of the most resistant organism at 100° C. was as follows: 1,200 minutes in corn juice of *p*H 6·1; 1,020 minutes in pea juice of *p*H 5·3; 360 minutes in sweet potato juice of *p*H 5·0; 210 minutes in spinach juice of *p*H 5·0; 360 minutes in string bean juice of *p*H 5·0; 210 minutes in beet juice of *p*H 4·7, and 210 minutes in pumpkin juice of *p*H 4·5.

Dickson[7] and his associates in 1922 reported experiments in which the heat resistances of *B. botulinus* spores in various concentrations of hydrochloric, citric, acetic, and lactic acids were determined. At corresponding *p*H values, there seemed to be little difference in the toxic effect of the various acids. The OH ion also exerted a toxic effect, as it was found that the heat resistance was much less in alkaline than in neutral solutions.

Esty[8] and Meyer conducted an extensive series of experiments to determine the effect of hydrogen ion concentration on the death point of *B. botulinus* in phosphate solutions. Difco pepton solutions, double strength veal infusion, spinach juice, and in juices expressed from many canned foods. Because of the action of buffer substances, much more acid was required to give the desired *p*H values in spinach juice than in phosphate and peptone solutions.

The spores in a citric acid solution of *p*H 5·26 were killed in 65 minutes at 100° C., at *p*H 4·69 in 40 minutes, at *p*H 4·31 in 20 to 25 minutes, while at *p*H 7 about 330 minutes was required.

Bigelow[9] and Cathcart, in studying the changes in hydrogen ion concentration occurring during the processing of many canned foods, found that the *p*H value decreased slightly in most cases, on account, they believed, of the coagulation of buffer substances and the formation of weak acids through decomposition of organic compounds by heat. In one experiment, however, that with beans in tomato sauce, there was an increase in *p*H value in the sauce, which the authors state was "due to diffusion of acid into the beans." Undoubtedly part of the change was due to this cause, but we believe, from our experiments with other products, that some of it may have been due to the buffer action of compounds leached from the beans during processing.

Changes in pH Value during Heating.—These investigators, however, did not determine the changes in *p*H value that occur during the sterilisation by heat of foods acidified to various *p*H values. Investigations by the writer showed that these changes may be very great. Unless they are known, it is impossible to judge accurately the effect of *p*H value on sterilisation by heat of vegetables canned in acidified brines.

Accordingly, various non-acid vegetables were canned in brines acidified with citric acid, hydrochloric acid, and acetic acid respectively to various *p*H values. The cans were preheated in steam for 6 to 8 minutes; they were then sealed and heated at 100° C. (212° F.) in boiling water for half-hour and for one-hour periods. The *p*H values were determined after exhausting and also after heating at 100° C. The *p*H value was determined colorometrically and by the hydrogen electrode.

Typical changes in *p*H value for three vegetables canned in brines acidified with citric acid are shown in Table I.

Table I.—Typical Changes in *p*H Value during Preheating and Sterilising of Brines Acidified with Citric Acid.

Vegetable and *p*H Value of its Juice.	*p*H Value of Original Brine.	*p*H Value of Brine after Pre-heating for 6-5 Minutes at 100° C. (212° F.).	*p*H Value of Brine after 60 Minutes Heating at 100° C. (212° F.).
Corn—*p*H 7·8	2·8	3·0	4·2
,, ,, ...	4·0	5·0	5·2
Green beans—*p*H 6·2 ...	2·8	3·0	3·8
,, ,, ,, ...	4·0	5·8	5·4
,, ,, ,, ...	6·0	6·0	5·4
,, ,, ,, ...	7·0	6·0	5·3
Spinach—*p*H 6·8 ...	2·8	3·0	4·0
Asparagus—*p*H 5·4 ...	2·8	3·0	4·0
,, ,, ...	3·0	4·0	4·5

It will be seen that the change was greater during the short preheating or exhausting period than during the much longer subsequent period.

Acidified brines increased greatly in *p*H value: that is, they decreased greatly in hydrogen ion concentration, a fact that proves the necessity of not only specifying the initial *p*H value but also the final *p*H value. The increase in *p*H value of acidified brines is caused by neutralisation (or "buffering") of the acids by substances from the vegetables and by diffusion of acid into the food.

In Table II. data are given to illustrate the relative changes in *p*H value of vegetables acidified with the strong acid, hydrochloric, and the two weak organic acids, citric and acetic. The procedure was that previously described.

Table II.—Changes in *p*H Value of Acidified Brines during Processing as Affected by Type of Acid.

Vegetable.	Acid Used.	Original *p*H Value of Brine.	*p*H Value of Brine after 1 Hour at 100° C. (212° F.).
Asparagus	None	7·0	5·0
,, ...	Hydrochloric	2·6	5·4
,, ...	Citric	2·6	5·1
,, ...	Acetic	2·6	4·6
,, ...	Hydrochloric	3·0	5·6
,, ...	Citric	3·6	5·6
,, ...	Acetic	3·9	5·4
Peas, green ...	None	7·0	6·0
,, ...	Hydrochloric	2·6	5·8
,, ...	Citric	2·9	5·4
,, ...	Acetic	2·6	4·8
,, ...	Hydrochloric	3·0	6·0
,, ...	Citric	3·0	5·7
,, ...	Acetic	3·0	5·4

In most cases the hydrochloric acid changed in *p*H value to a much greater extent than did the acetic and citric acids. This would naturally be expected because the hydrochloric acid is much more highly dissociated into H+ and C_1- ions than the weaker organic acids, and consequently less of it is required to produce a given *p*H value. Therefore, it has a smaller reserve of undissociated acid with which to form additional hydrogen ions, when the hydrogen ions present are neutralised ("buffered") by the vegetables. The acetic and citric acids are only slightly dissociated; therefore they possess a large reserve of undissociated acid to furnish additional hydrogen ions when those initially present are neutralised. In other words, they are themselves "buffer substances" and tend to oppose changes in *p*H value.

If the extent of the change in *p*H value for a given vegetable in an acidified brine of given *p*H value is known, and if in addition, as discussed later in this article, the effect of *p*H value on the death time of spoilage bacteria is known, then it would be possible to specify the initial *p*H value necessary to ensure sterilisation of a given vegetable in a specified time of heating at 212° F.

Comparison of Changes in pH Value of Different Vegetables in Acidified Brines.—Peas canned in brine of *p*H value 2·0 to 4·0 increased more in *p*H value than did carrots, artichokes, corn, green beans, spinach, and asparagus; these in turn were approximately equal in respect of their "buffering action" on the acidified brines. Typical data from these experiments are give in Table III.

Table III.—Relative Effect of Different Vegetables on Changes in *p*H Value of Brines Acidified with Citric Acid. (*See also* Table II.)

Vegetable	*p*H Value of Original Brine.	*p*H Value of Brine after Cooking 1 Hour at 100° C. (212° F.).
Carrots	3·0	5·2
,, ...	3·8	5·4
,, ...	4·4	5·4
,, ...	4·8	5·4
,, (check)	7·0	5·4
Peas (green)	3·0	5·7
,, ,, ...	3·0	6·0
,, (check)	7·0	6·0
Artichokes	2·0	4·6
,, ...	3·0	4·8
,, ...	3·0	5·3
,, ...	7·0	5·3

Similar data were obtained for the other vegetables mentioned above.

In all experiments in which the vegetables were canned in neutral brine of *p*H 7, the *p*H value of the brine decreased during heating, because the vegetables were of lower *p*H than the brine. Naturally, therefore, the brine changed downward in *p*H—*i.e.*, it increased in hydrogen ion concentration. Probably, also, weak acids are formed by heating and enhance this change. This is in accordance with the results obtained by Bigelow[9] and Cathcart.

Effect of pH Value on Death Time of Bacillus Sporogenes.—*Bacillus sporogenes* is a heat-resistant anaerobic spore-bearing bacillus, capable of growing in canned vegetables and spoiling them quickly. It is similar to the better-known, toxin-forming *Bacillus botulinus* in its appearance, the odour of canned food spoiled by it, and in its resistance to heat. It produces strong butyric acid odour in non-acid canned vegetables.

In experiments with asparagus, the stalks were cut to fit the cans (8-oz. size); the stalks were blanched in boiling water for 5 minutes, canned, the cans were filled with the brines of known *p*H values, each can was inoculated with 1 c.c. of a suspension of the spores, exhausted in live steam, sealed and processed in boiling water. One half of each lot of cans was processed for one hour and the other half for two hours.

The *B. sporogenes* spores were obtained by growth for four days at 37° C. in brain medium. The brain culture was diluted 1 to 3 with sterile water and 1 c.c. of the dilution used for each 8-oz. can of vegetables.

The processed cans were incubated and the propor-

tion of spoilage was determined at intervals during a three months' period.

The heat resistance of the spores is indicated by the fact that they survived three hours at 100° C. (212° F.) in meat broth medium and were killed at three and a quarter hours.

Table IV. gives some of the data obtained with asparagus.

TABLE IV.—EFFECT OF *p*H VALUE OF BRINE ON HEAT RESISTANCE OF *B. sporogenes* IN CANNED ASPARAGUS.

Acid.	*p*H Value of Original Brine.	*p*H Value of Brine after Processing.	Period of Processing at 100° C. in Hours (212° F.).	Per Cent. of Cans Spoiled.
Citric	2·6	5·1	1	33
Citric	2·6	5·1	2	0
Acetic	2·6	4·6	1	0
Acetic	2·6	4·6	2	0
Hydrochloric ...	3·0	5·5	1	100
Hydrochloric ...	3·0	5·5	2	33
Citric	3·0	5·4	1	66
Citric	3·0	5·4	2	0
Acetic	3·0	5·2	1	33
Acetic	3·0	5·2	2	0
Hydrochloric ...	3·6	5·6	1	100
Hydrochloric ...	3·6	5·6	2	100
Citric	3·6	5·6	1	100
Citric	3·6	5·6	1	66
Acetic	3·6	5·4	2	0
None (check) ...	7·0	5·6	2	100

Acetic acid proved more effective than hydrochloric and citric acids for a given initial *p*H value.

With an initial *p*H value of 2·6 from acetic acid, heating for one hour at 212° F. killed the organism. The final *p*H value was 4·6. For the same initial *p*H, one hour's heating at 212° F. did not sterilise when citric acid was used. The final *p*H was 5·1.

With string beans, spoilage did not occur after heating half an hour at 212° F., when the final *p*H was 4·8 or less; to secure this final *p*H value, the brine was acidified to *p*H 3·2. Spoilage occurred under similar conditions when the initial brine was *p*H 3·6 or of greater *p*H value and the final *p*H reached 5·0 or greater.

For sweet corn the critical final *p*H value was 5·0; above 5·0 spoilage occurred; below 5·0 the product did not spoil.

With peas, when the initial *p*H value was 3·0 or greater, spoilage occurred even after one and a half hours' heating at 212° F. (using citric, acetic, and hydrochloric acids). The final *p*H values were 5·4 to 6·0, depending on the acid used. At *p*H 4·8 with acetic and 5·4 with citric acid, spoilage did not occur after heating for one hour at 212° F. The initial *p*H value in both cases was 2·6.

Thermophilic Bacillus.—This organism was obtained from the National Canners' Association and is very resistant to heat. It withstood five and a quarter hours at 212° F. in meat broth medium, but was killed in five and three-quarter hours at 212° F. Its critical *p*H value in several vegetables was found to be in the neighbourhood of 4·8 to 5·0. That is, at a final *p*H value of 4·8 or less, the product inoculated with the spores did not spoil when heated for one hour at 212° F.

Using *Bacillus botulinus* spores capable of withstanding four and a half hours at 212° F. in glucose meat broth medium, it was found that the spores were killed in acidified brine used with asparagus in two hours at 212° F., when the initial *p*H value of the brine was 2·8 or less. Citric acid was used as the acidifying agent.

Peas were canned in brine containing 6 c.c. of lemon juice to 94 c.c. of brine and were inoculated with *B. botulinus* spores before heating for one hour at 212° F. The non-acidified check cans spoiled and were fatally toxic to guinea-pigs; the acidified product did not spoil and was not toxic. The final *p*H value was above 4·0.

Other data obtained with vegetables in acidified brines inoculated with *B. sporogenes*, and others inoculated with soil showed the critical *p*H value in most cases to be in the neighbourhood of 4·8.

It is believed that if the initial brine is so acidified that the *p*H value after processing (heating of sealed cans) is 4·5 or less, the product can be safely sterilised at 212° F. The vegetable must not, however, be packed too tightly, since then the acidified brine will not exert its full effect and sections of such a pack might remain at their natural low acidity during heating and spoilage would result.

Therefore, canning in acid brine as previously described is not suitable for tightly packed spinach. However, see the following discussion:

Spinach.—Spinach packed in the usual commercial manner, except that acidified brine was added and processed at 212° F., spoiled even when the average final *p*H was as low as 4·0. Evidently the acid brine failed to reach portions of the pack; hence the spoilage. However, when the spinach was blanched for 3 minutes at 212° F. in brine of *p*H 3·0 or less, and canned in brine of *p*H 3·0 or less, it did not spoil. Thus, by use of an acid blanch and acid brine in canning, it would be possible to process spinach at 212° F.

Artichokes.—Artichokes are now canned commercially in California by blanching in dilute citric acid solution and canning in brine acidified with citric acid to give a final *p*H value of about 4·5. The process is under the supervision of the California State Board of Health.

Application Industrially.—The various experiments described in this paper show that by acidifying the brines used in canning non-acid vegetables, or by blanching such vegetables in dilute acid, the products can be sterilised at 212° F., whereas the non-acidified products require heating under steam pressure at 240° F. to 250° F. The lower temperature affects the flavour less adversely than the higher and permits the use of open processors. It would seem that the critical final *p*H value is about *p*H 4·8, and that if the product were so acidified before processing in the cans that its final *p*H were, say, not above *p*H 4·5, a process temperature of 212° F. could safely be used: *p*H 4·5 is suggested instead of *p*H 4·8 in the interest of safety.

The housewife would find such vegetables tart or acid in taste, but not unpleasantly so, for use of the products in salad. In cooking for the table, the acid is easily neutralised by adding a "pinch" of baking soda (sodium bicarbonate) to the pot before or during cooking.

However, the method is experimental and is not ready for general application; see next paragraph.

Caution—Owing to the grave danger of poisoning from *Bacillus botulinus* toxin that might develop in canned vegetables not properly handled, *the writer does recommend this method for general industrial adoption, and recommends that if it is considered by canners it be applied under the strict supervision of a well-trained chemist or bacteriologist* and the inspection of a properly qualified public health department representative. This plan has worked well with artichokes in California, and with proper care, could, no doubt, be used with string beans, peas, and asparagus. If British canners should experiment with the method it is suggested they consult the Canning Research Station at Campden, England. The information in this article is presented to illustrate a principle rather than to advocate a new process.

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Oils from Canned Salmon

Their Composition and Vitamin Potency

WORK has been put in hand at the Fisheries Experimental Station, Prince Rupert, B.C., to determine the variation in colour, composition, and vitamin potency of the oil from canned sockeye and pink salmon from different areas. The following is a preliminary report by B. E. Bailey (*Progress Reports of the Pacific Biological Station, Nanaimo, B.C. and the Fisheries Experimental Station, Prince Rupert, B.C. Report No.* 11, December, 1931).

The trend of practically all food industries to-day is toward improved products by standardisation and greater knowledge of food values. Although for most food products variations due to raw material and methods of processing have been studied, there still remain some on which little research of a comprehensive nature has been carried out. This is particularly true of canned salmon.

Present economic conditions are making it increasingly difficult to market this valuable product. Furthermore, competition with other foodstuffs, on which research has been done, shows clearly the necessity for work of a scientific nature on canned salmon.

Recognising the necessity for scientific research in their field, the salmon packers of British Columbia requested the Biological Board of Canada to undertake a study of their product. After careful deliberation it was decided to proceed with a preliminary investigation, while plans for a more extended project were being considered.

In carrying out an investigation of any food product, the first thing to be studied is the composition. The most important components of foods are proteins, carbohydrates, fats, mineral substances, and vitamins. Proteins are used by the body to build tissues, fats and carbohydrates to supply energy, while mineral substances have many and varied functions.

With reference to these food factors, least is known about vitamins. These are present only in minute traces in foods, but they are indispensable to growth and health. They may be divided into two main groups: (1) Those that are soluble in water, (2) those soluble in oils. Chief among the latter are the vitamins A and D. Vitamin A promotes growth and enables the body to resist disease, while vitamin D is the antirachitic factor that controls bone formation in growing animals and prevents rickets. These two vitamins occur chiefly in fish oils and are present in the oil of canned salmon.

In two or three investigations, reported in the literature, on the vitamin potency of canned salmon, it has been suggested that there is a possible relationship between the amount of red pigment and the content of vitamin A. The data given, however, do not conclusively prove this. It is obviously important that this relationship be verified, since colour is a controlling factor in the saleability of canned salmon.

The work of the canned salmon investigations has been divided into two sections: (1) A study of the proteins and mineral constituents, which is being undertaken by the Pacific Biological Station at Nanaimo, B.C., and (2) the determination of the composition and vitamin potency of the oils, which is in progress at the Fisheries Experimental Station, Prince Rupert, B.C.

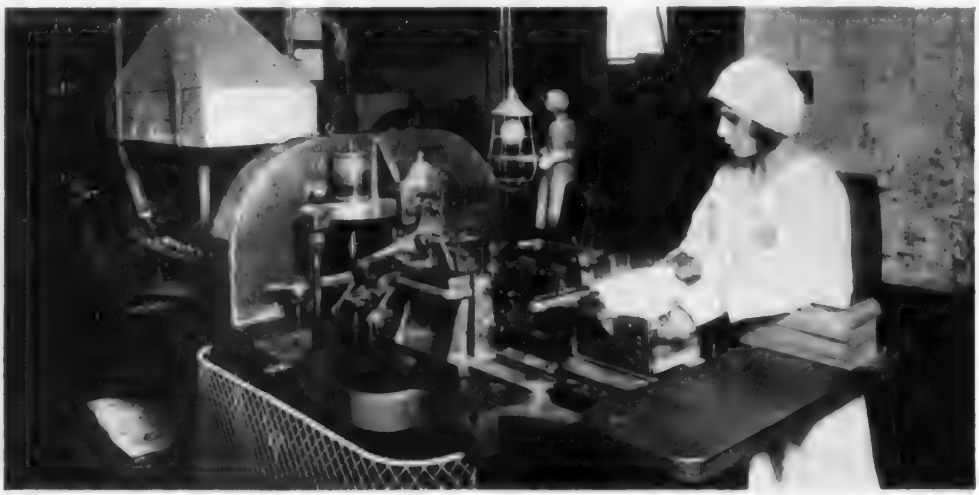
Fish Spoilage

In the Eleventh *Progress Report* of the experimental station at Prince Rupert, B.C., are recorded the results of some investigations by R. H. Bedford on the growth of some marine and other bacteria at low temperatures. Mr. Bedford shows that there are bacteria on fish which can grow over a wide range of temperatures, in some instances from at least −5° C. (23° F.) to 37° C. (98·6° F.); their maximum activity is between 20° C. (68° F.) and 25° C. (77° F.). At 0° C. (32° F.) they are quite active, and this is important in relation to fresh fish stored in ice. Even at −5° C. (23° F.) some of them are still active and therefore important in relation to cold storage.

Mr. Bedford admirably sums up in the following words the bearing which these facts have on practice:

Low temperature occupies a strategic position in the fish industry. Just as soon as fish are caught those agencies, amongst which are bacteria, which cause fish to spoil, gradually attain the ascendancy over the protective factors which are an inherent part of the normal physiological structure of any marine organism. In this phenomenon temperature plays an extremely important rôle, for if it is gradually raised these destructive agencies become much more active and, given sufficient time, the fish become putrid. But by lowering the temperature it slows down their rate of action and the duration of preservation is lengthened. This is the reason why ice helps to keep fish in a fresh condition, why the proper freezing of fish inhibits the destructive agencies entirely, and why storage for long periods at certain low temperatures is feasible. But it must be borne in mind that even freezing fish at very low temperatures, much lower than are ever used in refrigeration plants, will not entirely destroy these destructive agencies. It is true enough that numerous bacteria will be killed, but many will survive. Many survive as low a temperature as −190° C. (−347° F.) although there is no record to show for how long. Freezing at about −5° C. will in the course of time destroy some of the weaker bacteria, but many remain—some dormant, others growing slowly but surely.

The significance of this investigation to the industry is just this: Bacteria are fairly active at ice temperature, so that fresh fish are being effectively attacked immediately they are caught, and their period of storage is reduced. To counter this they must be properly stowed in ice so that this temperature is effective over the whole fish, and not stowed in such a manner that parts are left exposed to the warmer atmosphere. If proper stowage has not been practised and the temperature, say of the hold of a fishing vessel, has risen, then the march of decay has progressed, perhaps not to a noticeable extent, but it is there all the same, and if the fish is later frozen for storage the initial carelessness may have so changed the physical and chemical structure of the tissues that other changes must of necessity follow; what was once a first-grade product has deteriorated into a second or cull when it is ultimately required for market. In cold storage the temperature of the fish must be maintained below −5° C. (23° F.), otherwise the bacteria will gradually play their part in causing deterioration of the flesh. The growth of those bacteria which produce orange and yellow pigments at this temperature is not without significance where no reasonable control is exercised to stop the fluctuation of temperatures in the storage chambers. For instance, large quantities of halibut become yellow while in storage and cause a considerable financial loss.



A Can Body Making Machine installed at Messrs. Crosse and Blackwell's.
(Courtesy of E. W. Bliss Co. and "The Times.")

Heat Penetration in the Canning of Tomatoes

In view of the interest displayed in heat penetration and pre-sterilisation at the Convention of the National Canners' Association (see our comments on a previous page), we publish the following summary of a recent Italian article:

THE CANNING of tomatoes now represents an important section of the world's food preservation industries, and the recent thorough investigations into the conditions necessary for efficient sterilisation without sacrifice of nutritive values, which have been carried out in the laboratories of one of the largest Italian tomato canning concerns, have provided interesting data.

Important papers to which reference was made in the Italian investigations are those of Emanuele* and Bigelow†.

Some of the most interesting data refer to the temperature changes in the containers. For example, when immersed in a bath maintained at 110° C., a 1-kilo tin required a heating period of 79 minutes before its centre had reached 100° C. As the temperature rose to 102·5° C. within 14 minutes after removal from the bath, it is clear that the temperature of the contents at the periphery of the tin must have been still higher.

By applying a rotatory movement to the tins during sterilisation, a very marked speeding-up was effected; whereas 125 minutes elapsed before the temperature of the contents of a motionless tin rose from 30° to 95° C. (with a bath temperature of 100° C.), only 20 minutes were required to raise a rotating tin up to 98° C. Failing the necessary equipment for the rotatory system, excessive prolongation of the period of sterilisation can be avoided by preheating to 50° C. Nevertheless, as recorded by Emanuele, this modification does not allow of the attainment of a temperature capable of destroying bacteria in less than 60 minutes and spores in less than 140 minutes.

In the case of more concentrated juices (*i.e.*, double concentrate with a residue of 35 per cent. to 37 per cent.) there is a danger of excessive thermal action unless the products are preheated before transference to the containers. The method recommended to overcome this difficulty consists in preheating *en masse* to 80° with mechanical agitation.

The period of sterilisation varied with the size of the tins. A ½-kilo tin acquired complete sterility after preheating to 80° C. followed by 8 minutes in an autoclave at 105° C., whereas a ½-kilo tin called for a preheating temperature of 87° C. and 15 minutes in the autoclave at 105° C. By interpolation of the time-temperature curves compiled from data accumulated in experiments with small containers, it was deduced that containers of a larger size than 1 kilo could not be effectively sterilised in a reasonably short time, unless the entire mass were preheated to 95° C. Emanuele had previously shown that 1 kilo of double concentrate in a bath at 100° C. rose from 95° to 99° C. in 1 hour, whereas several hours elapsed before a 5-kilo batch rose to 97·5°; a 10-kilo batch only attained a temperature of 96° after many hours. The author is of the opinion that very prolonged heating of tomato juice is to be deprecated on account of the risk of formation of decomposition products of carbohydrates.

(Donato Franceschelli, *Giornale di Biologia applicata alla Industria Chimica*, Vol. 1, pp. 179-206.)

L. L.

* "Heat Penetration in Food Preserve Tins," *L'industria italiana delle Conserve alimentari*, March, 1928, p. 3.

† "Heat Penetration and its Application to Canning," *Canning Age*, Convention Digest, 1928.

A General View in the Can Department of the same Factory.

(Courtesy of E. W. Bliss Co. and "The Times.")

Trade Notes

British Cardboard for Boxes.

In the past this country has been very largely dependent on foreign sources of supply for its requirements of cardboard for boxmaking. The position, however, has been gradually changing, and it is gratifying to learn that very considerable extensions to the boardmaking industry are already taking place. In 1912 the production of board was 50,400 tons. By 1930 it had grown to 205,000 tons. A big factor in the growth of the industry in this country has been the remarkably rapid development of the Thames Board Mills at Purfleet, which has the largest output of any mill in Europe.

In 1924 the output of this mill was about 1,000 tons per week. Its present capacity is 2,500 tons per week. A decision, however, was recently made to considerably extend the works and output of this mill, and additional plant, estimated to double the present output, is already being constructed. Next year it is expected that the output will be well on the way to 4,000 to 5,000 tons per week. As other home mills have also recently increased their capacity, and some are adding fresh productive units, it is not too much to expect that within the next twelve months a very big proportion of the present imports will be replaced by board manufactured in this country. The difficulties, therefore, in connection with the supply of cardboard boxes or the raw material from which they are made are purely temporary, and there will be enough British board before long to satisfy all reasonable requirements.

It is of interest to learn that the extensions to the above mill involve placing contracts with British manufacturers of machinery and building contractors to a value of £500,000. It is also interesting to learn that the production of board, involving, as it does, the employment of very large quantities of coal, this increased production will represent a coal output giving continuous employment to some hundreds of miners.

* * *

Business Changes.

Since 1925 Medway's Safety Lift Co., Ltd., has been controlled by Messrs. J. and E. Hall, Ltd., of Dartford, Kent, and the design and manufacture of their lifts have been carried out at J. and E. Hall's works. In December last the assets and outstanding contracts of the Medway Company were taken over by J. and E. Hall, Ltd., who are continuing the business as a department of their organisation, with the whole of the personnel formerly employed by the lift company. The change really involves no more than a limited amount of internal reorganisation, the effect of which should be to benefit present and future users of these lifts by increasing resources and promoting general efficiency. It is to be noted that, in addition to lifts of all types, Messrs. J. and E. Hall, Ltd., are now manufacturing escalators to the design of the Carl Flohr Company, of Berlin. Five of these have recently been installed at Messrs. Bentalls' new store at Kingston-on-Thames, and another escalator order has been received from Messrs. Hammonds, of Hull.

* * *

A new factory, surrounded by a garden one and a half acres in extent, has just been taken over by the Visco Engineering Co., Ltd., adjacent to the aerodrome, Stafford Road, Croydon. Production in the new works, which are now being equipped with up-to-date plant for the production of air filtration and dust recovery plants, ventilating and water-cooling systems, etc., is expected to commence about June.

* * *

Tariff Changes.

A Venezuelan Executive order, published and effective February 4, 1932, increases the rates of import duty on an extensive list of products, including prepared and canned meats, shellfish, fish, oysters, salmon, herring, sardines, pickles, prepared cereals, unprepared vegetables, prepared and canned vegetables.

The new rates of import duty, in Bolivares per gross kilogram, are as follows, old rates being shown in parentheses:

Foodstuffs. — Prepared foods of animal products, not specified, 0·75 (0·25 plus surtax of 50 per cent. of duty); preserved poultry and canned meats, not specified, 0·75 (0·25); shellfish, fish, oysters, and salmon, 0·75 (0·10 plus a surtax of 50 per cent. of duty); herring and sardines, 0·75 (0·10); pickles, prepared cereals, prepared and canned vegetables, 0·75 (0·25 plus surtax of 50 per cent. of duty); unprepared vegetables, 0·75 (0·25); alimentary cereals, 0·75 (0·25 plus surtax of 10 per cent. of duty.

* * *

With a view to assisting canners and would-be canners throughout the Empire, several of the largest British manufacturers of canning equipment have arranged for the distribution of their machinery, in so far as overseas buyers are concerned, through a central London organisation—Messrs. Westgate, Ltd. It is hoped that, by this means, British makers will be more able to compete with foreign competitors and that those who are interested in purchasing canning plant will be able to obtain authoritative information on plant and processes from one source. It will be appreciated that the convenience of being able to direct enquiries for British plant to one address only in this country, instead of several, must mean a very large saving in time and trouble to those in the more remote parts of the Empire. By utilising this central organisation, it is claimed, buyers will be able to obtain first-hand prices, not only for processing machinery, but also for power plant, canmaking and labelling machinery, conveyors, and any other associated equipment.

* * *

A new departure which the organisation is also sponsoring is the supply of all-made-up flattened cans. The cans are shipped in flattened form in order to economise in freight charges and reformed on special machines supplied for the purpose. The flattened can itself is merely the can body, the side seams of which have been soldered, and they are shipped in collapsed form with the tops and bottoms packed separately.

We are informed that the following firms are among the members of this new organisation: Messrs. Joseph Rhodes and Sons, Ltd.; Messrs. Mather and Platt, Ltd.; Messrs. Metal Box Co., Ltd.; Messrs. Beth Label and Wrapper Machine Co., Ltd.; Messrs. William Brierley, Collier and Hartley, Ltd.; Messrs. Marshall Sons and Co., Ltd.; Messrs. British Mathews, Ltd.; and Messrs. Westgate, Ltd., canning consultants.

* * *

New Regulations for Smoked Herrings.

Under the authority of Section 4 of the Fish Inspection Act, Chapter 72, of the Revised Statutes of Canada, 1927, and by an Order in Council, P.C. 153, dated January 23, 1932, Subsection (*b*) of Section 83, of the regulations governing the construction and capacity of containers was repealed and the following substituted therefor:

"(*b*) There shall be two sizes of boxes for the marketing of medium smoked herrings, one of a size to contain not less than two pounds and the other to contain not less than one and one-half pounds of fish."

* * *

Canned Salmon Shipments.

While the salmon pack ordinarily is sold by August in each year, British Columbia packers are understood to have carried into 1931 some million cases of the unsold pack of 1930, and at the time the salmon fishing season opened still had on hand about 600,000 cases, chiefly pinks, according to information received from Vancouver. The domestic market consumes approxi-

mately 350,000 cases annually, principally sockeye, so from the 600,000 cases carried over to July 1, and the pack for the year, there were about 000,000 cases available for export in 1931. Estimated shipments for the year 1931, about half of which moved during the last six months, as compared with shipments in 1930, are set forth below:

	British Columbia Canned Salmon Shipments. Calendar Year.	
	1930.	1931.
	Cases.	Cases.
Australasia ...	171,135	149,119
Belgium	40,447	36,574
Central and South America ...	41,687	11,452
France	146,614	92,370
Italy	132,480	15,087
South Africa ...	27,827	21,849
United Kingdom	258,378	393,750
Canada, Atlantic Coast	111,570	107,150
Total shipments ...	1,021,640	894,056

A feature in the year's trade in canned salmon was the decline of almost 40 per cent. in exports to France as a result of the tariff preference granted by the latter country to Japan. On the other hand, owing to the practical application of the principle of Empire trade, British purchases increased by approximately 35 per cent. While the home market buys chiefly the smaller pack of high-grade salmon, the adverse French market since the middle of the year has been keenly felt, as it affected the disposal of about half of the pack of low-grade species, principally pinks, which ordinarily comprise between 30 and 50 per cent. of the total salmon pack of the province.

* * *

Canning Lacquers.

A leaflet describing the two well-known lacquers, Super-Zinnatine and Sulfatine, has come to hand from Messrs. Arthur Holden and Sons, Ltd. Of the 27,000,000 cans of fruit officially estimated to have been packed in this country last year, it is claimed that the greater proportion were lacquered inside with Super-Zinnatine. In the case of the vegetable pack, where sulphur contents have to be overcome, Sulfatine was also very extensively used. For fish canning, due to the methods used in stamping the tins, an elastic lacquer is needed, and Zinnatine Charina has been introduced for this purpose.

* * *

Corrosion-Resisting Aluminium.

The varied commercial applications of "Birmabright," a strong corrosion-resisting aluminium alloy, are described in a very well-produced and illustrated booklet issued by Birmabright, Ltd., of Smethwick. This metal is available in sheets, angles, rods, sections, forgings, stampings, and castings, etc., and by virtue of its ductility, fatigue resistance, and capacity for working and welding and other physical properties, it is already being extensively employed for products ranging from architectural fittings to rail waggon tanks, and from chemical engineering plant to motor-car bodies. The composition of the alloy makes it a very desirable material for contact with foodstuffs, the handling or processing of fish, for example, and the construction of plant for handling meat which has been treated with SO_2 as a preservative. Its light weight has stimulated its use for the construction of road transportation tanks, such as those now in common use for milk collection, and its capacity for spinning, pressing, and welding render the fabrication of such plant as condensers, heat interchangers, pans, pumps, or coolers a matter of no special difficulty. Interested readers who employ equipment of this type and who wish to investigate the possibilities of Birmabright would do well to request a copy of the booklet from the makers.

* * *

Steam Traps.

The revised type of the popular "Weldeck" steam trap is described in a leaflet issued by the Drayton Regulator Co. The new model possesses the following advantages:

Brass hot pressed bolted-on covers for ⅜, ½, and ¾ inch sizes; high-grade mall. iron bolted-on cover for 1-inch size, which are easily and quickly removable by means of one spanner.

Rust-proofed, machine-moulded bodies of high-grade cast-iron.

Improved capsule construction giving large capacity, greater sensitivity, and sharper action.

Coarser thread on setting screw with less tendency to strip or jam when hot.

All traps individually packed in stout, labelled carton, convenient for storage.

No increase has been made in prices.

* * *

Inspection of Japanese Canned Crabmeat.

During the period January 1 to November 20, 1931, the Japan Canned Crab Association inspected 648,064 cases of crabmeat, of which 232,000 cases were re-inspected for export. The cases re-inspected were a carry-over from the 1930 season, showing inspection of 416,060 cases for 1931, a decline of 158,878 cases from 1930. There are some 17,000 cases produced during 1931 not as yet inspected, showing a net decrease from 1930 of 141,000 cases.

The following figures show the result of the inspection by grades:

Floating Canneries.—246,830 cases and also 7,386 cases; total inspection, 254,216 cases (or 147,857 cases decline against 1930).

Shore Canneries.—Kamchatka, 63,049 cases (decline, 4,405 cases); Nemmro, 37,235 cases (increase, 7,780 cases); Saghalien total, 55,000 cases (decline, 2,800 cases); Wakanai, Hokkaido, 11,872 cases (increase, 5,357 cases).

Shore Canneries.—Fancy, 70,354; choice, 16,686; fair, 17,129; P.A., 20,712; P.S., 20,509; not graded, 22,715; rejected, 1,005.

Floating Canneries.—Fancy, 175,778; choice, 17,109; fair, 5,031; P.A., 35,097; P.S., 7,682; not graded, 2,143; rejected, 0.

The following table shows inspection by sizes:

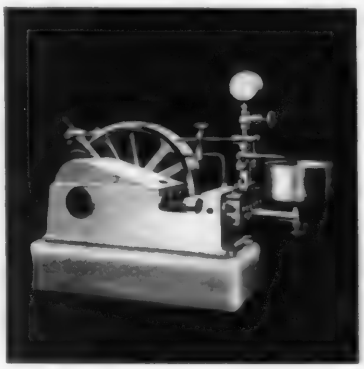
	1931.	1930.
	Cases.	Cases.
1-lb. tin ...	46,072	84,575
½-lb. tin ...	307,755	453,643
¼-lb. tin ...	62,233	36,720
Total ...	416,060	574,038

Stocks of canned crabmeat on hand in Japan on November 30, 1931, amounted to 321,103 cases. Stocks were somewhat decreased during December, 1931, and the Japan Canned Crab Association estimates that at the year end 313,000 cases were in stock.

* * *

An Oil-Bath Homogeniser.

A number of novel features are incorporated in the design of the "Rannie" homogeniser, one type of which is illustrated herewith. The pistons and cylinders, for instance, are of stainless



steel, and the valve housing is machined from a single stainless steel block—commendable features when delicate foodstuffs are being processed, besides the added safety against bursts which such construction gives. The machine operates at an unusually high speed for equipment of its type, and, as this enables all gears to be dispensed with, much quieter working is assured. All the bearings are lubricated by an oil bath, and this, it is claimed, considerably reduces the power required for operation, while the homogenising valve is of a special patent type, said to give an unusually high degree of homogeneity. The homogenisers are built in capacities ranging from 11 to 265 imperial gallons per hour, arranged either for belt or electric motor drive.

Enquiries

Enquiries are dealt with immediately on receipt, and the desired information is communicated in full by private letter. The replies given below are merely brief abstracts or indications that the names and addresses, or whatever may have been requested, have been supplied. Any further information supplied to us relating to the questions appearing below will be passed on to the enquirers. **N.B.—Enquirers are requested to use the special form in the advertisement section.**

551. *Could you give me a recipe for making coconut ice, using the solid coconut oil. Also I should be glad to have suggestions for using this oil for the flavouring of toffee and various other kinds of confectionery goods.* (Gloucester.)

The confectionery trade needs to consider four different forms of this oil. Crude coconut oil is high in fatty acids (free), which means rancidity, and is not fit for use in any edible product. When the crude oil has been refined the major portion of this free acid is removed, the oil whitened, and a very bland, pleasing fat remains. The melting-point is between 23 and 25° C. (75 to 76° F.). This melting-point is lower than is required for many types of confectionery use, and is raised to any desired degree either by hydrogenating the fat or by pressing out a proportion of the lower melting-point factors and selling the remainder as coconut stearines.

The pressed fat seems, for some reason, to be better suited for use in chocolate than the hydrogenated material. It is more expensive, however, and presents no advantage over the hydrogenated for use in such things as toffees, caramels, etc.

The "refined" or "edible" coconut oil is much used by the toffee trade in England, but *not*, so far as we know or have heard, as a flavouring ingredient. The actual reason for its use is to get a fat which is the cheapest possible acceptable ingredient. It is combined with a high melting-point fat, either coconut or palm kernel, in proportions which vary with the season of the year. In winter it is not uncommon to use all coconut oil, while in the hottest summer days none is used. Every different percentage is used by different manufacturers during the intervening seasons. A common mixture for a large part of the year is ½ coconut oil and ½ palm kernel fat hardened to a melting-point of 96 to 98° F.

We have never heard of using any coconut oil or other free fat in coconut ice. There would be no purpose in doing so, and it would be a drawback, as the free fat gives a stodgy texture to what should be a short, light, fondant base. There is a great deal of fat in the coconut itself, and every effort is used, in making coconut ice, to avoid extracting this into the batch.

There is a possibility that certain makers of a very cheap product may use "Ceroline" (untoasted cornflakes) instead of coconut, and that they add a small proportion of coconut oil to soften this and give a suggestion of flavour to the ice, but we do not think this probable. A synthetic coconut flavour is too easily procured and of too high a quality to make it worth while playing about with the oil itself.

We are sorry we cannot give you direct answers to your questions, but there are none to give, and we feel that the logical short reply would be: "There are no such formulæ."

552. *How to make invert sugar in the form of a colourless syrup or a white fondant paste.* (Birmingham.)

The actual conversion of sucrose is not a difficult or complicated operation, but it is quite another matter to ensure that every batch shall be free from ash, white in colour, and altogether true to standard. These claims are, in fact, made for the invert sugar marketed under the name of "Nulomoline."

553. *Kindly put us in touch with firms making peppermint cutting machines.* (Holland.)

This was done.

554. *Please furnish particulars on manufacture of malt extract and state the names of books dealing with this subject; also books on cocoa and chocolate.* (Cheshire.)

The manufacture of malt extract was described in the June, 1931, issue (p. 176) and the August, 1931, issue (p. 230). Its manufacture and uses are also dealt with in the *Food Industries Manual*.

The enquirer was given the names of books on malting, on cocoa, and chocolate.

555. *I should be glad if you could furnish me with information as to a biscuit mixture which, when baked, would be suitable for puppies about to be weaned, preferably one having a fair proportion of skimmed milk added.* (Devon.)

We would imagine that one made from low-grade soft flour and bonemeal made up with skimmed milk and about 1 per cent. of calcium lactate might prove a satisfactory mixture for the purpose.

556. *Can you give names and addresses of British firms supplying up-to-date butter moulding machinery making ½-lb. bricks, rolls, or curly rolls?* (Hamilton.)

These requirements were furnished.

557. *We are anxious to obtain the names of firms who can supply us with the highest grade powdered vegetables, such as onions, turnips, carrots, parsnips, etc.* (Reading.)

These were supplied.

558. *Please supply names of firms who specialise in small bakers' ovens, heated by coal, coke, or electricity.* (Exeter.)

This was done.

559. *Kindly supply references to the manufacture of lemon curd.* (Bradford.)

See FOOD MANUFACTURE, February, 1932, p. 51; also the May, June, and August issues, 1931.

560. *Can you give me a list of books dealing with the refining of lard and margarine; also on currants, sugar, canning, etc.?* (Leeds.)

The best plan is to refer to the bibliography section of the *Food Industries Manual*.

561. *I would be glad to know what are the latest methods for the curing of fish by smoking, salting, and drying. We import smoked herrings, etc., and also cod, pollack, and hake which have been brined and dried. There is an abundance of fish going waste in this colony that could be salted and exported, but we are ignorant of the proper methods of curing.* (Demerara.)

You will appreciate that it is impossible to give any really useful information on the canning, salting, and drying of fish in the course of a letter, as this is a very big subject and, moreover, the particular procedure varies according to the type of fish and other conditions. However, the following very generalised remarks may be of some assistance to open up the subject:

Smoking consists in exposing the articles fresh or, as is more frequently the case, slightly salted to the action of smoke produced by smouldering wood, bark, or sawdust. Its efficiency depends upon the drying as well as the action upon the texture of the fish of the pyroligneous acid pro-

duced by the smouldering, which at the same time imparts an agreeable flavour to the product.

After being dressed the fish are at once struck with salt, the length of the salting differing according to the species being prepared. On removal from the pickle the fish are cleansed and attached to smoking-sticks, and after drying for a few hours are placed in the smoke-house, or, in the case of halibut, they may be dried on cod flakes for a day or so and then strung on sticks and placed in the smoke-house. All fish cure better and present a neater appearance when cured if dried in the open air a few hours before being placed in the smoke-house.

Both cold smoking and hot smoking are employed, the result of those two processes being quite different. In the former, the fish are suspended at a distance from the fire and smoked at a temperature less than 80° F.; in the latter process the fish are partly or entirely cooked while smoking, being hung near the fire.

The style of the smoke-house depends on the particular product for which it is intended.

Once you are acquainted with the general principles involved, it is really a matter for you to make some trials with the particular fish you are handling, and work out the procedure which is best adapted to your conditions.

Taking the case of "Finnan Haddies" as an example, a preliminary immersion of the fish in a strong salt brine for one half to one and a half hours is the first step in improving the keeping quality, by retarding bacterial growth through the dehydrating action of the salt, while it also affects the flavour to some extent. A rapid drying of the surface, especially just before smoking, produces a "pellicle" and "sheen" over the surface and helps to retain moisture inside the fish. The factors involved are, therefore: Condition of the fish, method of splitting, quality of brine, time of brining, initial rapid drying, quality of smoke, and time of smoking.

Actually the various steps are: (1) Removing the head, splitting, and eviscerating. (2) Salting in strong brine (*e.g.*, 90 per cent. saturated); fillets for about half an hour, haddies for about one to one and a half hours; some colouring matter may be added to the brine. (3) Draining and drying. The fish are placed on rods in tiers in the smoke-house. Clear fires of hardwood shavings (or sticks) are lit on the floor, and the smoke-house is kept well ventilated so that the warm air passes quickly over the fish, which should be dried in the least possible time—say, two and a half to three hours for fillets, and four to five hours for haddies. The temperature should be under control; 90° F. may be allowed if the outside atmosphere is dry and cool. (4) Sawdust is put on the fires to produce smoke, and the temperature kept below 80° F. Good circulation of air and smoke is important. Fillets may be smoked four to five hours and haddies eight to ten hours, or until the desired colour is obtained. (5) After smoking the fish are cooled before packing.

For the principles involved in salting you should read the U.S. Bureau of Fisheries' Document No. 919 (1922), by Harden F. Taylor. Further references and notes have been published in previous issues of FOOD MANUFACTURE.

562. *Kindly supply a recipe for Worcestershire type sauce.* (Chicago.)

There are endless recipes for this and, indeed, for most other types of sauces. The enquirer was given an example and advised to make his own experiments. Furnishing recipes for sauces is obviously not a satisfactory proceeding.

563. *I shall be glad if you can let me know of firms who supply small made-up waxed paper bags and envelopes for putting in samples of seals, etc.* (Gloucester.)

Suggestions were made.

564. *Can you give us the name and address of the makers of Cascaphane?* (Weston-super-Mare.)

This was done.

565. *With reference to the enquiries in your February issue, we would like you to put us in touch with your enquirer for powdered lemon peel (No. 490), and also with Nos. 491 and 496.* (London.)

This was done.

566. *We should be glad of some particulars relating to powders used as detergents.* (London.)

Some particulars were published in the September (1931) issue of FOOD MANUFACTURE. It was stated that washing powders on the market fall into four general classes, containing sodium carbonate, caustic soda, trisodium phosphate, and soap respectively. One powder commonly used (of American origin) contains ground pumice, sodium carbonate, and soap. Some contain trisodium phosphate alone. Another consists of anhydrous sodium silicate mixed with sodium perborate. Hypochlorites are added in some instances. Resinates and gums are also occasionally found in powders.

567. *We would like to know the names and addresses of makers of butter moulding and weighing machines.* (Newcastle.)

These were given.

568. *Kindly recommend a book on baking powder and other leavening agents.* (Leicester.)

By far the most complete account is to be found in the book *Cake-Making and Small Goods Production*, by Bennion and Stewart.

569. *Please suggest any textbooks covering the food packing industry.* (Cape Town.)

Refer to the bibliography in the *Food Industries Manual*.

570. *Kindly forward recipes for potted meats.* (London.)

Examples were furnished, but, as often remarked in this connection, the only satisfactory way is for the enquirer to make a careful examination of representative samples, having in mind some basic recipes, and then start to build samples up for himself, using the particular materials available. It is surprising how much one can learn with the aid of a saucer, a little water, and a good magnifying glass.

571. *I shall be glad if you will favour me with recipes for fish pastes.* (Canada.)

See the previous enquiry.

572. *Could you supply me with addresses of firms given to enquirer No. 514 re moisture-proof packets for preserving eggs?* (Scotland.)

This was done.

573. *Von welcher englischen oder sonstigen Firma beziehen wir Pflanzmaterial von Loganbeeren, mit deren Anbau wir in Deutschland ebenfalls einen Versuch machen möchten?* (Germany.)

Enquirer referred to East Malling Research Station, Kew Gardens, and the Horticultural Research Stations at Bristol and Cambridge.

574. *In the February number of* FOOD MANUFACTURE *on page 37 are shown seamless containers named "Utilicon." Kindly give me the name of the manufacturers of these.* (Copenhagen.)

This was done.

575. *I would be greatly obliged if you could send me the address of the British Navarre Machinery Co., Ltd., to which reference was made in this month's issue.* (Cheshire.)

This was supplied.

576. *Please supply names of manufacturers of fruit canning machinery.* (Warwickshire.)

These were furnished.

577. *What are the different ways of getting pectin into solution?* (Scotland.)

(1) Mixing the pectin powder with glycerine or alcohol and adding hot water.

(2) With the aid of sugar.

(3) Adding the pectin powder to warm water gradually and at the same time agitating vigorously by a high-speed mechanical agitator.

The suppliers of pectin will furnish full instructions, and you are advised to write to them.

578. *How is it possible to treat bacon fat to produce a good lard?*

We do not see how you can possibly produce a first-class quality lard from bacon fat.

You are no doubt acquainted with the fact that best quality material is obtained from back fat, kidney fat, and leaf lard, etc., and that even the lard from these has to be chilled and refined to give a good quality product.

Refining is usually done by means of fuller's earth, which absorbs the colouring matters in the fats. This is really a bleaching process. The quantity of earth used depends on the quality of the raw product; ½ to 1 per cent. is considered a good average for lard. After, the lard is thoroughly agitated for fifteen to twenty minutes by air or mechanical agitators, and then the lard is filtered by a filter press.

You might try this, or you might try the addition of a small amount of caustic soda, about 2 lb. to 100 gallons of lard, which will effect a certain amount of bleaching. It must be remembered that bacon fat has a distinct discoloration due to its curing and treatment, and therefore it will be difficult, if not impossible, to obtain pure white lard from this material.

We are afraid that it would be contrary to the Food and Drugs Act to add a " wax " to toughen the lard. For this purpose about 5 per cent. of lard stearine could be added. It is also sometimes the practice to mix lard with tallow and to market it under a trade name or to sell it as a compound.

579. *Where can I obtain information on the sealing in small glass jars of peeled shrimp under vacuum?* (Lancashire.)

We have dealt with this process several times in past issues of FOOD MANUFACTURE. The enquirer was referred to the maker of a suitable machine for the purpose.

580. *Kindly refer me to sources of information on investigations carried out in connection with the utilisation of fruit products, such as beverages, wines, concentrates, pulp, etc.* (Somerset.)

We would suggest you write to the various research stations in the United States, such as the New York State Agricultural Experiment Station, and especially to Professor Cruess at Berkeley. As you probably know, Cruess has made a special study of the utilisation of surplus fruit in connection with Californian crops. There is a good bibliography of papers in Campbell's book on canning. Some interesting pamphlets have been issued by the Fruit Branch of the Department of Agriculture at Ottawa and by the Department of Agriculture at Washington. Dahlberg has written on the manufacture of water ices and sherbets, and there have been various American papers written on the preparation of ice-cream and fruit mixtures.

581. *Please supply names of manufacturers of a metal ring for locking on cardboard caps to glass jars.* (London.)

This was done.

582. *Please supply names of makers of a machine for drying eggs to produce flakes.* (London.)

Names were furnished.

583. *Information required on the machinery used in the preparation of tapioca.* (London.)

We are not clear whether you require information on the machinery employed for the preparation of cassava starch, or the preparation of tapioca from this starch.

In the main, the operations involved in the extraction and purification of cassava starch in modern factories are similar to those employed in potato starch manufacture.

Tapioca is a partially gelatinised form of cassava starch, and the change is brought about by heating the starch in a steam-jacketed pan. The material is loosened with a small spade, the process being finished when the starch has formed into translucent lumps.

For a description of the machinery used in the preparation of starch you will find a good account in the book *Starch: its Chemistry, Technology, and Uses*, by Eynon and Lane (1928).

584. *Kindly supply name of an English firm making a machine for the peeling of pickling onions.* (Lancashire.)

Names were furnished.

585. *Please give names of firms able to supply almond shelling machines.* (London.)

This was done.

586. *Would you please send us information on the methods used in China for the breaking and freezing of eggs?* (London.)

A copy of a paper describing these processes was sent to the enquirer.

587. *Friends of ours in Central America ask for a book on jam-making. Can you refer us to any?* (London.)

There is no modern book dealing with this subject. The enquirer was referred to past articles in FOOD MANUFACTURE and to certain books that deal in part with the subject.

588. *Kindly supply recipes for potted salmon and salmon paste.* (U.S.A.)

Examples were furnished. See reply to Enquiry No. 570.

589. *We are anxious to find some firm who could make machinery for us suitable for grinding beans under water.* (Yorkshire.)

Suggestions were made.

590. *We should very much appreciate if you could put us in touch with manufacturers of artificial sausage casings.* (Leeds.)

This was done.

Corrections

To the Editor.

DEAR SIR,

I think it only just that the suggestion made on page 364 of your journal, Vol. vi., No. 12, that Californian canners receive subsidies should be corrected.

I am authorised to state that there is no Federal, State, or other subsidy, direct or indirect, granted to canners in California.

As far as I know, there is no subsidy granted in any other part of the United States. Certainly there is no Federal subsidy of any kind.

Yours very truly,
FRANK HUSBAND.

[*The statement to which our correspondent refers was made at the Canners' Convention at Manchester last November during the conference with retailers and distributors.*—EDITOR.]

* * * * *

Our attention has been drawn to an error in the temperature given in the answer to Enquiry No. 505 in the March issue. This should, of course, be 240° F.—not 40° F. as stated.

New Companies

Empire Fruit and Food Products, Limited. (F.3050.) 28, Victoria Street, S.W. Incorpd. in the Isle of Man on Dec. 21, 1931. Formed to carry on the bus. of growing and dealing with all fruits and foodstuffs, etc., throughout the Empire. Nom. Cap. : £21,000 in 20,000 pref. and 20,000 ord. of 10s. and 1,000 defd. shares of £1.

Madame X (Birmingham), 1932, Limited. To carry on the bus. of confectioners, bakers, etc. Nom. Cap. : £100 in £1 shares.

Harrowdene Trading Company, Limited. (262602.) To carry on the bus. of confectioners, mnfrs. of and dlrs. in sweetmeats, refreshment room keepers, etc. Nom. Cap. : £100 in £1 shares.

A. M. Hoe, Limited. (262483.) To carry on the bus. of nurserymen, growers of and dlrs. in cucumbers, tomatoes, fruits, etc. Nom. Cap. : £250 in £1 shares.

Aston Cakes, Limited. (263149.) 199, Aston Road, Birmingham. To carry on the bus. of dlrs. in confectionery, etc. Nom. Cap. : £1,000 in £1 shares.

J. O. Payne, Limited. (263169.) 315, Underhill Road, East Dulwich, S.E. 22. To carry on the bus. of bakers, etc. Nom. Cap. : £500 in £1 shares.

Tropical and Colonial Produce Company, Limited. (263083.) To carry on agency, trading, and financial business in connection with estates and undertakings for the cultivation of rubber, tea, coffee, tobacco, etc. Nom. Cap. : £100 in £1 shares.

Ideal Creameries, Limited. (263031.) 10, Duke Street, London Bridge, S.E. 1. To carry on the bus. of dairymen, margarine mchts., etc. Nom. Cap. : £100 in £1 shares.

Metianu and Skinner, Limited. (263135.) 222, Ulster Chambers, 168, Regent Street, W. To carry on the bus. of dairymen, etc. Nom. Cap. : £1,000 in £1 shares.

Q.G.H. Syndicate, Limited. (263141.) 127 and 128, Queen's Gate, S.W. 7. To carry on bus. as proprs. of hotels, restaurants, etc. Nom. Cap. : £1,000 in £1 shares.

Partners' Famous Old-Fashioned Sweets, Limited. (263139.) 16, Hampstead Road, N.W. 1. To carry on the bus. of mnfrs. of and dlrs. in sweetmeats, etc. Nom. Cap. : £200 in £1 shares (192 ord. and 8 defd.).

Mayville Confectionery Company, Limited. (263133.) 16, Mytton Street, Hulme, Manchester. To carry on the bus. of mnfrs. of and dlrs. in sweetmeats and confectionery, etc. Nom Cap. : £1,000 in £1 shares.

British Produce and Bacon Factories, Limited. (263114.) 1, Budge Row, E.C. To carry on the bus. of pig, poultry, and cattle breeders, bacon curers, agriculturists, etc. Nom. Cap. : £250 in £1 shares.

W. J. Beckett, Limited. (263146.) 13, Finsbury Square, E.C. To carry on the bus. of dairymen, etc. Nom. Cap. : £1,000 in £1 shares.

Plantation Products, Limited. (263140.) 41, Great Tower Street, E.C. 3. To carry on the bus. of dlrs. in rubber, coffee, tobacco, etc. Nom. Cap. : £100 in 5s. shares.

E. Geldart, Limited. (263059.) To take over the bus. of a preserve mnfr. cd. on by E. Geldart at Carrfield Road, Sheffield. Nom. Cap. : £3,500 in £1 shares.

Sunderland Ice Company, Limited. (263041.) To take over the bus. of ice mnfrs. and mchts. cd. on by the Sunderland Ice Co. at Sunderland. Nom. Cap. : £9,000 in £1 shares.

Maclanco, Limited. (263036.) To take over the bus. of a mnfg. confectioner cd. on by A. R. Webb at Swanfield Works, Waltham Cross, Herts, and the trade-mark "Maclanco." Nom. Cap. : £5,000 in 4,000 pref. shares of £1 and 5,000 ord. of 4s.

The above-mentioned particulars of new companies recently registered have been extracted from the daily register of Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C. 2.

Recent Trade Marks

This list of Trade Marks of interest to readers has been selected from the "Official Trade Marks Journal," and is published by permission of the Controller of H.M. Stationery Office. The "Trade Marks Journal" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

VITASAL.—526,079. **Salt (for food).** The firm trading as Price, Chatt and Co., 12, Lime Street, London, E.C. 3. March 2.

ARCTIC JOY.—526,989. **Chocolate coated ice-cream.** Hood's Dairy Products, Ltd., 86, Cadogan Street, Glasgow, C. 2. March 2. (Associated.) (By Consent.)

GOLFLAKE.—527,212. **Milk powder (for food) and condensed milk.** Silk-Spray Manufacturing Co., Ltd., 46, Fish Street Hill, Eastcheap, London, E.C. 3. March 2. (By Consent.)

SILVER SPRAY.—527,890. **Substances used as food or as ingredients in food, but not including butter, cheese, margarine, hogs' produce, lard, flour, salmon, tea, coffee, and confectionery, and not including any goods of a like kind to any of these excluded goods.** J. and J. Lonsdale and Co. (London), Ltd., Fennings Wharf, London Bridge, London, S.E. 1. March 2. (Associated.)

GOLDEN SPRAY.—527,891. **Substances used as food or as ingredients in food, but not including butter, cheese, margarine, hogs' produce, flour, salmon, tea, coffee, and confectionery, and not including any goods of a like kind to any of these excluded goods.** J. and J. Lonsdale and Co. (London), Ltd., Fennings Wharf, London Bridge, London, S.E. 1. March 2. (Associated.)

SONNYGROVE BRAND.—527,926. **Tea and coffee.** The firm trading as Robinson Batty and Co., 19, Temple Street, Liverpool. March 2.

MARRSONA.—527,951. **Tinned meats, tinned soups, and other tinned meat products.** Midgley and Parkinson, Ltd., Warren Works, Swinnow Lane, Pudsey, Leeds. March 2. (By Consent.)

SONNY.—528,455. **Biscuits.** Domenico Antonelli, trading as the International Biscuit Co., Progress Works, Ayres Road, Old Trafford, Manchester. March 2.

RENMOW.—528,875. **Marshmallow pastes for use as food or as ingredients in food.** John F. Benshaw and Co., Ltd., Locks Lane, Mitcham, Surrey. March 2. (Associated.)

SWEET NELL.—528,783. **Substances used as food or as ingredients in food, but not including oranges, grapefruit, and apples, and not including any goods of a like kind to any of these excluded goods.** Carr and Co., Ltd., 54, Church Street, Carlisle. March 2.

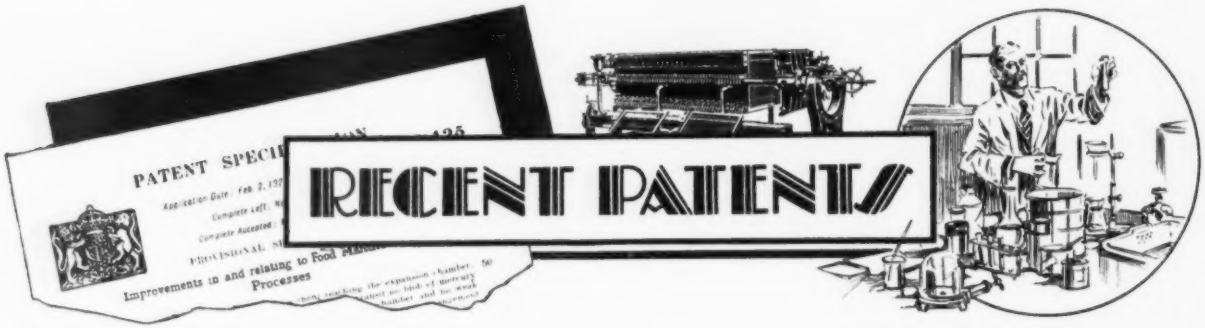
CONROYL.—528,886. **All goods in Class 42, which includes substances used as food.** Conserves Products, Ltd., Conserves House, 1, Goodmans Yard, Minories, London, E. 1. March 2.

GOOD LUCK.—517,850. **Sugar confectionery.** White, Hudson and Co., Ltd., Globe Works, Shakespeare Street, Southport. February 24.

VIGORESSE.—525,145. **All goods in Class 42, which includes substances used as food.** Eustace Hamilton Miles, 10, Ridgmount Gardens, Gower Street, London, W.C. 1. February 24.

MOLLIES.—526,491. **Chewing gums.** Confectionery Sales, Ltd., 34, London Wall, London, E.C. 2. February 24.

WINDROCK.—528,516. **Biscuits.** Fortnum and Mason, Ltd., 182, Piccadilly, London, W. 1. February 24.



These particulars of New Patents of interest to readers have been selected from the Official Journal of Patents, and are published by permission of the Controller of H.M. Stationery Office, and the Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications

5845. COOKSON, K.: Tonic foodstuffs. February 26.
5905. GERARD, A. A. R.: Preserving fruit, eggs, etc. February 27.
3722. BOYLES, F. M.: Food jelly. February 8.
3741. CALIFORNIA FRUIT GROWERS' EXCHANGE: Jelly preparations. February 8.
3869. TWISTED BREAD SERVICE, INC.: Bread, and method of making same. February 9.

Specifications Published

366,909. EMULSOL CORPORATION: Production of margarine and like edible fat emulsions.
367,105. TROPICAL VITAMIN CO., INC.: Production of citrus fruit concentrates.
367,294. VICKERS, H.: Process of preparing cooked meats.
367,303. VICKERS, H.: Process of preparing cooked meats.
366,771. KREMMLING, A.: Moulding of pastries and confectionery.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2., at the uniform price of 1s. each.

Abstracts Published

Group abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per group volume, or in bound volumes price 2s. each.

357,732. **Vitamins.** SANDT, H. VAN DE, 58, Freiligrathstrasse, Dortmund, Germany.
Vitamins are obtained from heat-treated yeast or heat-treated malt germ. Thus, normal brewers' yeast is autolysed at 50° C., the liquefied product is pressed, and the pressed out liquor is evaporated to dryness in a vacuum.

361,956. **Food preparations.** BERCZELLER, L., 6, Bleichgasse, Vienna.
Residues suitable as foods are obtained by extracting soya-beans and similar seeds containing lecithin in the cold or warm with solvents in which substantially only the lecithin and easily oxidisable substances are soluble. Suitable solvents are ethyl or methyl alcohol, or other water-soluble alcohols. Prior to extraction the seed may be heated while steam or gases are passed therethrough. Examples are given, in one of which soya-beans are sprayed with water, unhusked, dried at 100° C., comminuted and extracted with alcohol. Specifications 205,011 and 285,417 (both in Class 2 (iii.) Dyes, etc.) are referred to.

361,262. **Food, condiments, and medicinal preparations.** SELTZER, W., 114, Autumn Street, Passaic, New Jersey, U.S.A.
Aqueous emulsions of oils, fats, or waxes for use as or in making salad dressings, butter substitutes, salves, or lotions are prepared with the aid of meterabic acid. For example, to a 5 per cent. solution of the acid 1-4 or more parts of oil or liquefied fat may be added with stirring and the product diluted with water or aqueous solutions.

359,984. **Extracting sugar.** TEN BOSCH, A., 205, Van Lawick van Padststraat, Arnheim, Holland.
A process for removing liquid from material containing many capillary spaces, stated to be applicable for removing sugar juice from cane or beets, consists in bringing into contact with the draining surface of the mass under treatment a heater liquid, other than the liquid to be removed, and simultaneously subjecting the mass to mechanical pressure. The removal of the liquid may be promoted by cooling the interior of the mass at one or more points. A concentrated sugar solution may be used as the heated liquid. Apparatus is described comprising a vessel with perforated wall along which hot liquid is passed, the mass within being pressed by a plunger which carries a number of small tubes, through which a cooling liquid is circulated.

361,461. **Cocoa preparations; food preparations.** THORNTON, A. A., 7, Essex Street, Strand, London (BROWN, L. M., 29, South La Salle Street, Chicago, U.S.A.).
In the process for extracting fat from ground cocoa nibs, by treating an aqueous suspension of the material with proteolytic enzymes, the mother liquor containing peptised proteins, enzymes, etc., obtained after removal of fat, is filtered to remove fibre, etc., and the filtrate is concentrated *in vacuo*. Lime may be added during the concentration. The concentrate is treated with a solvent, such as benzene or alcohol, to extract the theobromine therefrom, and the residue constitutes a peptone-containing food product suitable for use as a base in the preparation of candy or meat extracts. When using alcohol the proteins are precipitated by diluting with water.

Obituary

WE regret to announce the death from pneumonia of Mr. Hubert Tidswell, at his home, Chorlton-cum-Hardy, Manchester, on the 7th ult. Mr. Tidswell was a director of Messrs. Tidswell, Bailey and Tidswell, Ltd., "Chef-de-Set" Mills, Manchester, and also of Messrs. Goodwin Tidswell, Ltd., essence distillers of Manchester. He was held in high esteem by his fellow-directors, staff, and employees, and was well known "on the road" almost all over the country. To the close of his life he took an active interest in the business which he had taken a great part in establishing. He was a prominent Freemason P.Prov.G.D., West Lancs Province.